

Global Precipitation Measurement - Report 5

Potential Tropical Open Ocean Precipitation Validation Sites

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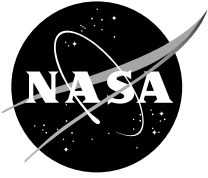
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Precipitation Validation Sites

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1.0 Introduction

The ultimate choice for a tropical open-ocean site for the upcoming NASA Global Precipitation Mission (GPM) will rest on a cost/benefit analysis taking into account the candidate sites' precipitation amount and distribution, logistical considerations, and existing infrastructure. The intent of this report is to provide factual input into that analysis by distilling basic information on the precipitation, logistics and infrastructure for 14 candidate sites. Two maps of the Pacific Ocean basin and the Indian Ocean basin are provided for locating 13 of the 14 sites (all but Key West, Florida). Kwajalein has served well as the open-ocean site for TRMM Ground Validation since 1997 and is used as a baseline for comparison.

The report consists of two components: a synopsis of each candidate site and a table of information listing all sites. Each synopsis in Part I is organized into the following components: Overview, Location, Advantages, and Disadvantages. Maps and Average Monthly Rainfall Graphs are included in each site section. Where data is available for the Average Number of Days per Month with Measurable Rainfall, another graph is included for the site. The overview discusses physical geography of each site: its location, island land area, and topography. After a brief historical background, the overview describes the current state of affairs both on the island and in the rest of the nation. The overview ends with a description of the precipitation climatology. The Location supplies latitude and longitude information, and Maps show the relevant islands as well as the surrounding region. All rainfall graphs in this document use the same axes for easy comparison. The sections on Advantages and Disadvantages discuss each potential site in terms of precipitation climatology, infrastructure, economic and political stability, health, entertainment, transportation, and labor sources. The second component of this report lists each site within one consolidated table. The table supplies many details that are not covered in the synopses.

2.0 Sources

Information for the report was gleaned from a variety of sources. The report relies heaviest upon the CIA's *World Fact Book*, 2000 edition. Travel handbooks such as the Lonely Planet series and the Moon Travel series supply a wealth of pertinent information that is unavailable most anywhere else. These books were written by professionals with first-hand accounts. NOAA and its National Climatic Data Center (NCDC) provided most of the climate information. Weatherbase maintains a huge climate database in a user-friendly format on its Web site. The organization has researched the NCDC archives, the Utah Climate Center at Utah State University, as well as many international sources. Most maps in the report are available from the University of Texas at Austin Library Web site. The library maintains a constantly updated and ever expanding collection of world maps. It is reputedly the best source of maps on the internet. Jane Resture's Web site on Oceania provides the remainder of maps. She has traveled extensively throughout Oceania and has researched archives all over the region including those in Canberra, Australia, and Wellington, New Zealand. Every attempt was made to include current information for each site.



Figure 1. Potential tropical open-ocean precipitation validation sites in the Pacific Basin: Atafu, Fongafale, Kiritimati, Koror, Kosrae, Kwajalein, Pohnpei, Temaiku, Tutuila, Weno, and Yap islands.



Figure 2. Potential tropical open-ocean precipitation validation sites in the Indian Basin: Gan and Diego Garcia islands.

3.0 Potential Candidate Sites

3.1 Atafu

3.1.1 Overview

Atafu Atoll and the rest of Tokelau are located in the South Pacific Ocean, halfway between Hawai'i and New Zealand [CIA, Tokelau]. Atafu is one of three small coral atolls within the dependency of Tokelau. All three islands together cover 10 sq km, of which Atafu makes up three sq km. Tokelau has a maximum elevation of 5 m [CIA, Tokelau]. Polynesians settled the islands long before Europeans ever discovered them [CIA, Tokelau]. In 1889 the islands were made a British protectorate [CIA, Tokelau]. In 1925 the New Zealand government assumed Tokelau's protection [CIA, Tokelau]. Most recently, the people of Tokelau are drafting their own constitution that defines a free association

pact with New Zealand [CIA, Tokelau]. Tokelau's isolation has kept the economy from expanding [CIA, Tokelau]. The island relies on massive aid from New Zealand for public services due to its lack of resources [CIA, Tokelau]. Communication is now more reliable with the aid of satellites [CIA, Tokelau]. The lack of airport runways [CIA, Tokelau] would hamper any radar experiment based from Atafu or any other atoll within Tokelau. According to NCDC data, rainfall is more evenly distributed throughout the year in Tokelau than on Kwajalein (see graphs). Fifty-two percent of the average annual rainfall occurs in a period from November to March. A secondary seasonal maximum occurs during the southern hemisphere winter months of June, July, and August. The driest months occur in April, May, and September.

Location: 9.0 S 172.0 W



Figure 3. Tokelau (2000). Atafu Atoll lies closer to the southern position of the ITCZ than the other two atolls [University of Texas at Austin Library].

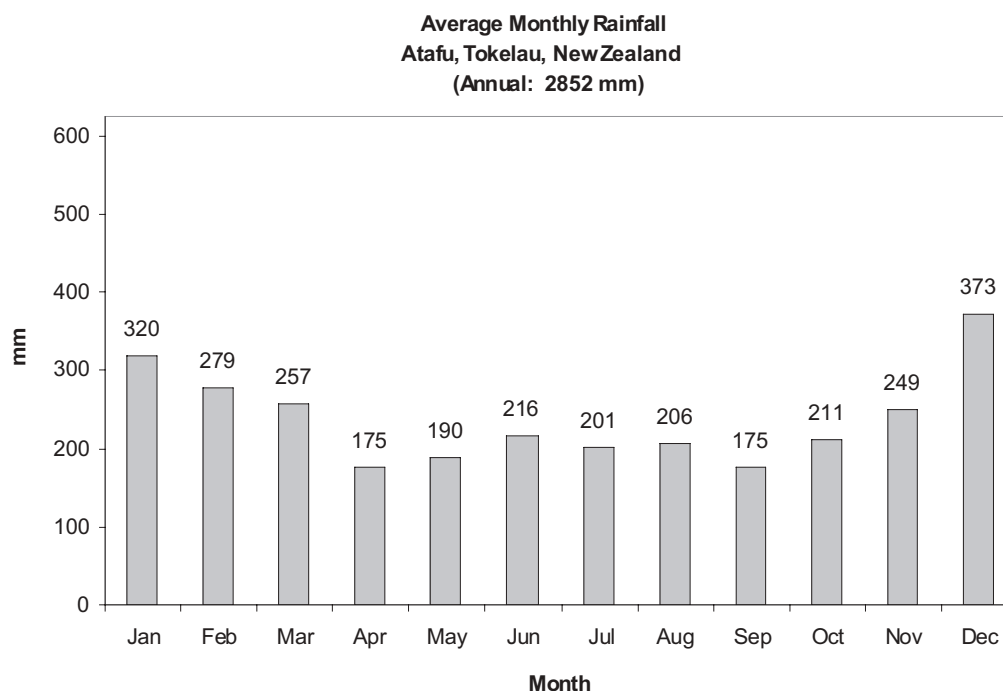


Figure 4. Rainfall for Atafu, Tokelau [Weatherbase].

3.1.2 Advantages of Atafu

- Atafu is a low-lying atoll with no topographical obstructions to a radar beam.
- The people of Tokelau have forged a relatively stable government under the protection of New Zealand [CIA, Tokelau].
- The economy uses the stable New Zealand dollar as currency [CIA, Tokelau].

3.1.3 Disadvantages of Atafu

- The monthly average rainfall on Atafu during the wet season is less than Kwajalein. Although on average Atafu Atoll receives more rain annually than Kwajalein (Atafu: 2,800 mm, Kwajalein: 2,600 mm), the rainfall is not as seasonally concentrated on Atafu [Weatherbase].

- There is no airfield for support aircraft [Stanley, p. 516].
- The island has poor access. There is no commercial jet service; only boat and seaplane services are available [Stanley, p. 516].
- The island has little infrastructure such as electricity and inadequate fresh water supplies [CIA, Tokelau].
- Although English is one of the official languages, many do not speak English.
- Besides diving, the atolls offer few forms of Western entertainment such as golf or tennis [Stanley, pp. 511-518].

3.2 Diego Garcia

3.2.1 Overview

The British Indian Ocean Territory (BIOT), of which Diego Garcia atoll is a part, is situated in the South Indian Ocean halfway between Africa and Indonesia. Diego Garcia is a low-lying atoll of 60 sq km [CIA, BIOT]. Although the highest point on the island reaches 15 m in elevation, most of the island lies below 4 m above mean sea level [CIA, BIOT]. The Chagosians, natives of Diego Garcia, were first subjected to Portuguese control, then French, and finally British during the last few centuries [CIA, BIOT]. Upon occupation by the British, the crown combined all Indian Ocean possessions into the British Indian Ocean Territory to be governed by an appointed commissioner from London [CIA, BIOT]. Diego Garcia continues to be a part of the BIOT. In 1965, the U.S. and Britain agreed to use the island as a joint defense outpost for the Indian Ocean region [CIA, BIOT]. In collusion with the Americans, the British uprooted the Chagosians and moved them to Mauritius and the Seychelles from 1967 to 1973 [CIA, BIOT]. Today Diego Garcia is dominated by

a U.S. military contingent assigned to a gigantic U.S. naval support facility [CIA, BIOT]. The population consists of 1,700 UK and U.S. military personnel as well as 1,500 civilian contractors, mainly from the UK, U.S., Mauritius, and Philippines [CIA, BIOT]. In 2000 native Chagosians won a high court case in London seemingly allowing for their resettlement onto Diego Garcia [CIA, BIOT]. It has been suggested that the British might be forced to ask the Americans to abandon the base early (BBC). The agreement presently states that the Americans must renew their lease on the island with the British before it expires in 2016 [CIA, BIOT]. Infrastructure and communications must be excellent to meet U.S. military needs. The island has its own internet service. Most recently, many news agencies have reported that B-52 bombers are gathering on the island in preparation for an expected American military action in response to four hijacked airliner crashes in New York, Virginia, and Pennsylvania [Loeb and Priest, Schmitt and Shanker, CNN].

Location: 6.0 S 71.5 E

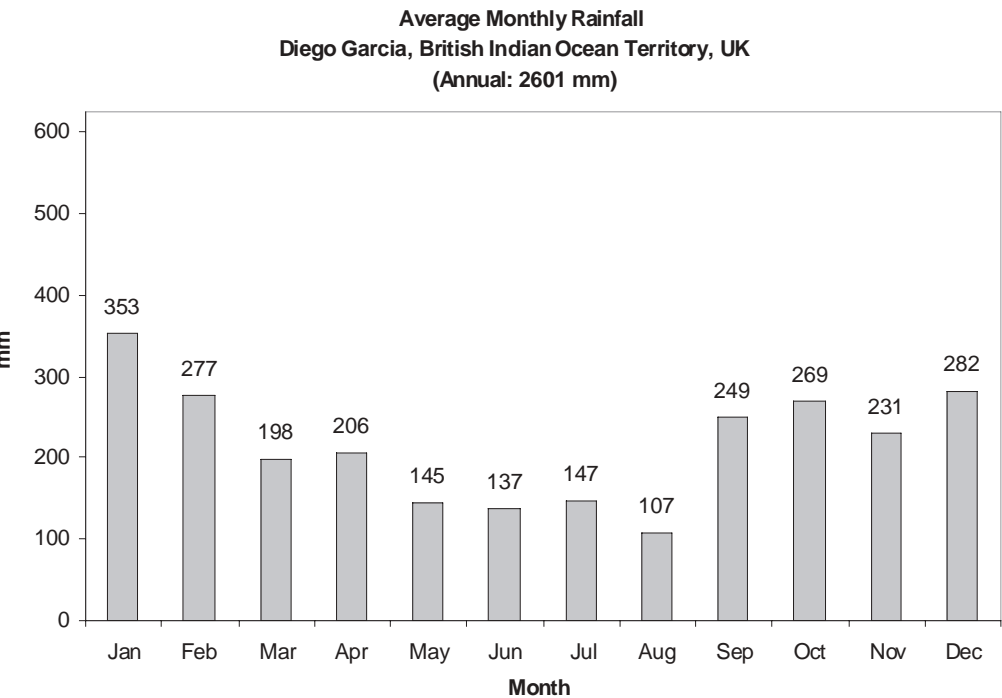


Figure 5. Rainfall for Diego Garcia, British Indian Ocean Territory [US Navy Oceanography].

3.2.2 Advantages of Diego Garcia

- Diego Garcia is administered by the British government. The U.S. military leases the island for a joint British-American military base. The British remain one of the U.S.'s closest allies [CIA, BIOT].
- The American military ensures reliable electricity, communication (including good internet connection and three radio stations), and high-quality food and water supplies [CIA, BIOT].
- Diego Garcia's air force base and naval air station use a presumably well-maintained runway. With a length of over 3 km, the runway is much longer than the one at Kwajalein (see map).
- The military provides ample recreational opportunities favored by Westerners such as a gym, a 9-hole golf course, a driving range, a bowling center, and a swimming pool.
- The military population is educated and skilled.
- Diego Garcia is a low-lying atoll. The island's relief offers a minimum number of potential radar obstructions. Communication towers are the exception [CIA, BIOT].
- Everyone speaks English [CIA, BIOT].
- The U.S. dollar is accepted as currency as well as the British pound [CIA, BIOT].

3.2.3 Disadvantages of Diego Garcia

- Annual rainfall amounts are no greater than Kwajalein (Kwajalein: 2,600 mm, Diego Garcia: 2,600 mm). Therefore, there would be no inherent climatological advantages in transferring operations to Diego Garcia from Kwajalein [U.S. Navy Oceanography and Weatherbase].
- The Chagosians no longer reside on the island. Universal military employment exists since the island remains a giant military complex. The military contracts with nationals from the Philippines, Mauritius, the UK, and the U.S. to carry out construction projects on the bases [CIA, BIOT]. It is unclear at what cost labor would be available for construction, maintenance, and operation of a radar site.
- There is an uncertainty with U.S. military continuity. The current lease with the UK expires in 2016 [CIA, BIOT]. Rumors are circulating that the UK might ask the U.S. to leave sooner to accommodate native Chogasians returning to the island in the near future (BBC).
- Diego Garcia receives no commercial jet service. The US military provides the only transportation to the island from a U.S. naval base near Tokyo, Japan [U.S. Navy].
- Due to the most recent preparation for U.S. military action, Diego Garcia is almost assured of being off-limits for non-military sponsored scientific research.

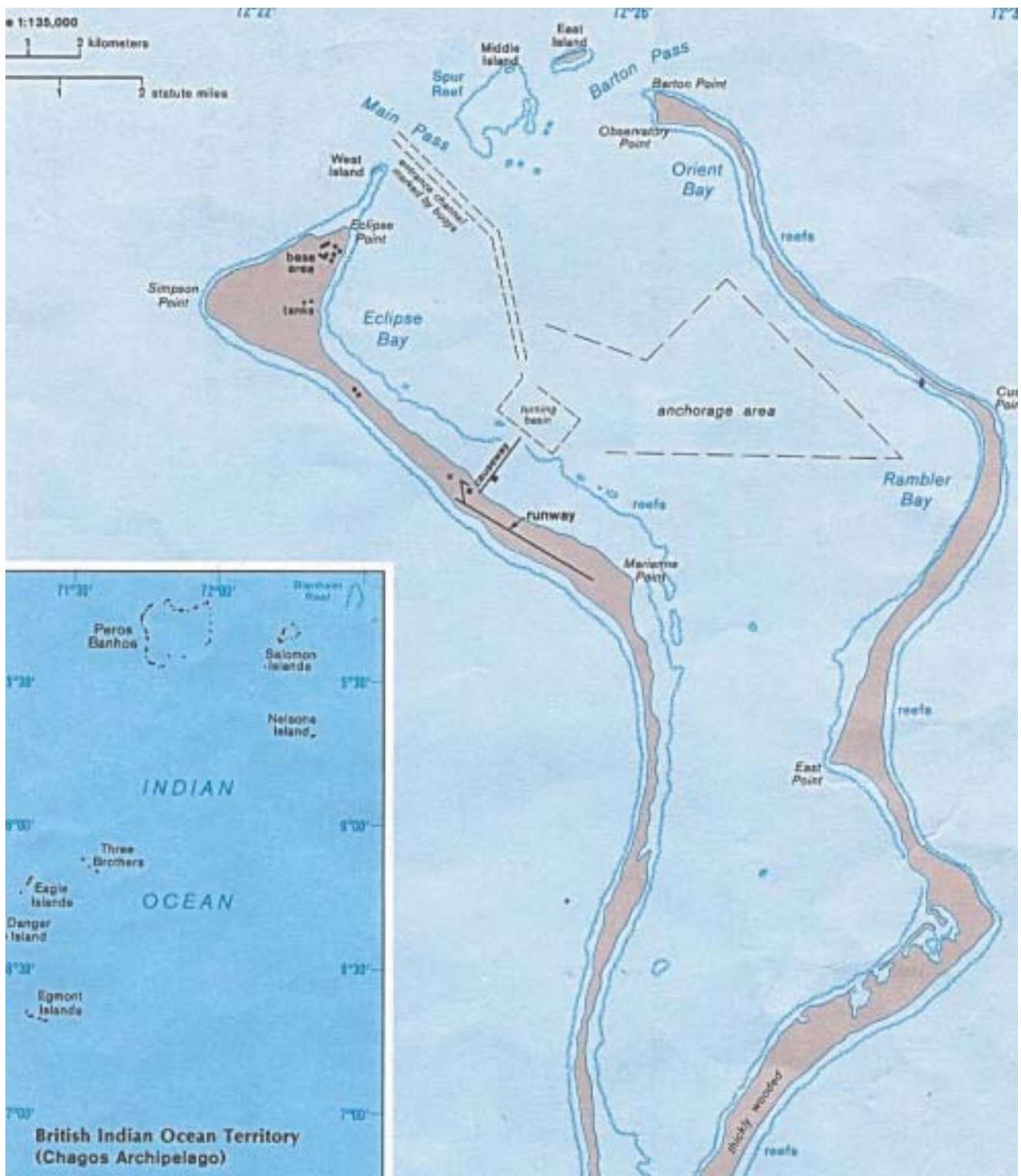


Figure 6. Diego Garcia, British Indian Ocean Territory (1980). The military bases are situated on the atoll's northeastern shores [University of Texas at Austin Library].

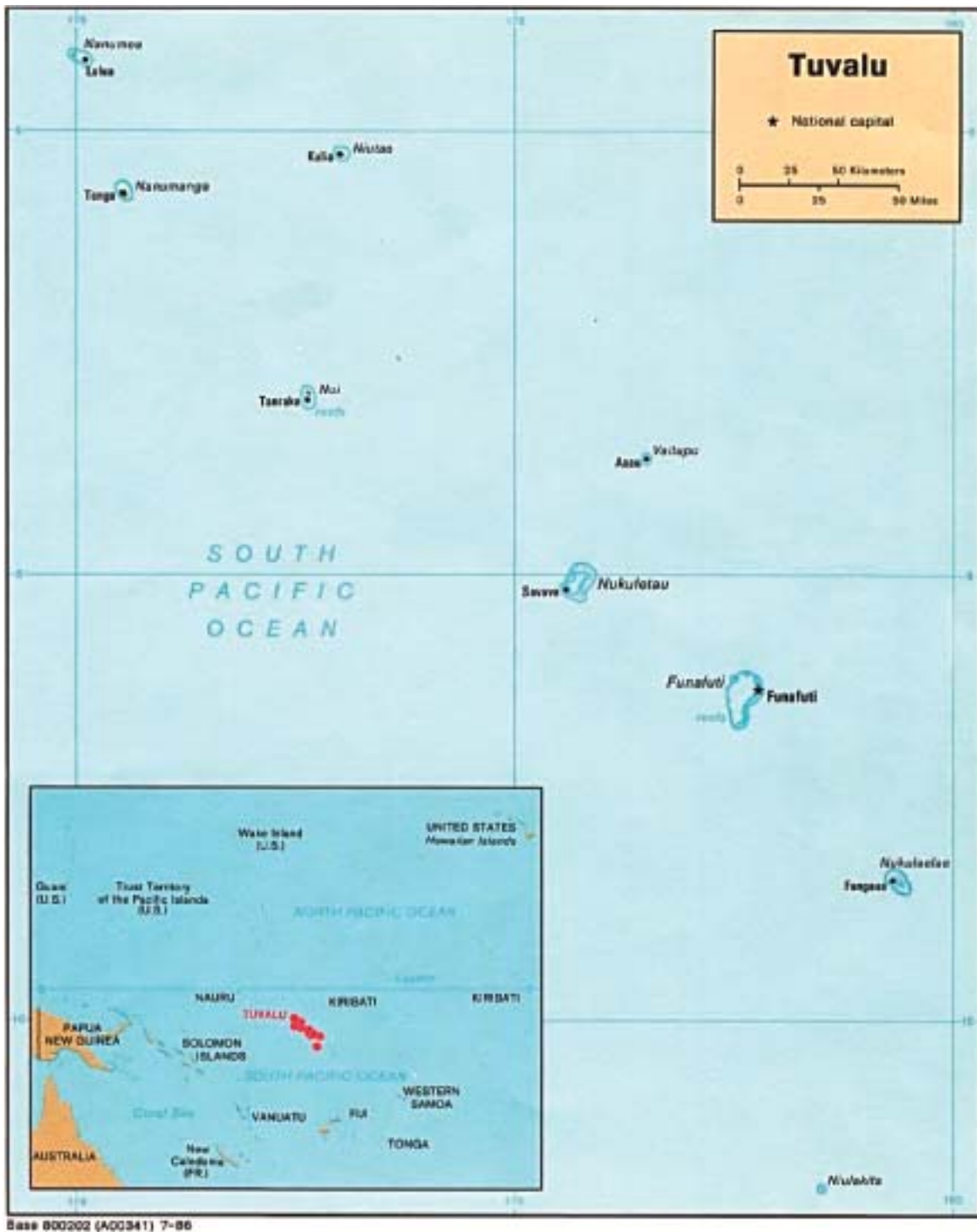


Figure 8. Tuvalu (1986). Funafuti is the largest atoll in the chain [University of Texas at Austin Library].

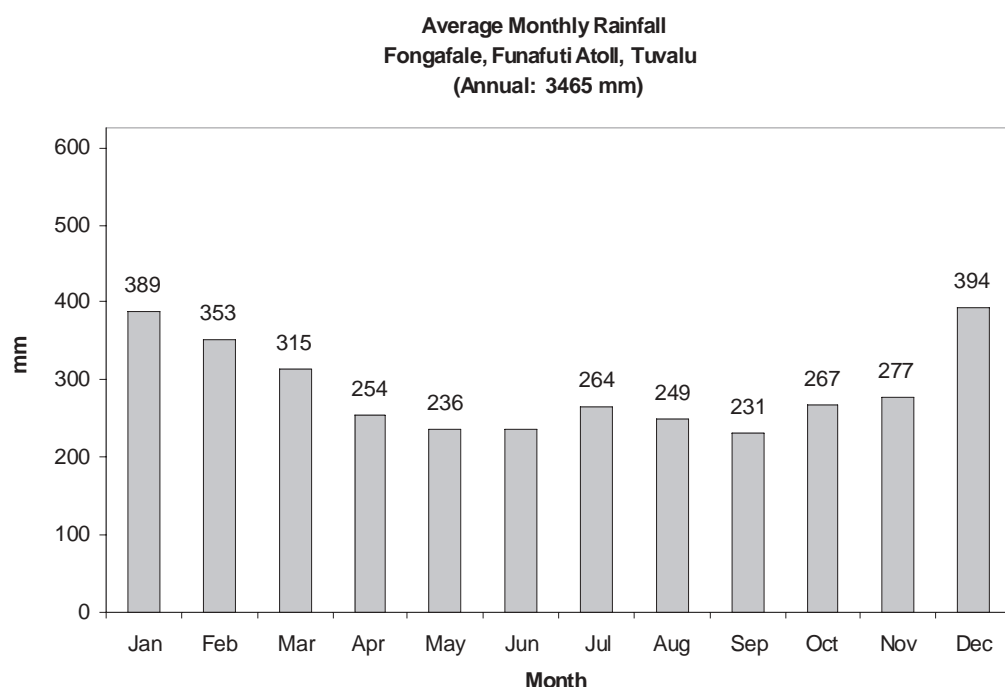


Figure 9. Rainfall for Fongafale Island in Funafuti Atoll, Tuvalu [Weatherbase].

3.3.2 Advantages of Fongafale

- Fongafale and the Funafuti Atoll receive on average nearly 3,500 mm of heavy rainfall per year according to Weatherbase records. This is 34 percent more annual rainfall than on Kwajalein (Kwajalein: 2,600 mm, Funafuti Atoll: 3,500 mm).
- The island is situated in Funafuti Atoll. Because of this, there are no naturally occurring topographic barriers to radar beams. The only obstructions would likely be communication towers.
- The Tuvaluan government is stable. It refrains from promising too much too quickly. Smart investment in the country's few resources and promotion of sustainable development through long-term solutions have helped keep peace [CIA, Tuvalu].
- The island population suffers from underemployment; therefore, finding cheap labor in support of the project might be easier than finding labor support on other islands.

3.3.3 Disadvantages of Fongafale

- Tuvalu shows few signs of sufficient infrastructure for the energy needs of the project. Although desalinization plants are helping, the supply and quality of drinking water are still in constant jeopardy [CIA, Tuvalu]. The island has poor soils, and most food is imported [CIA, Tuvalu].
- Although English is an official language, the majority of citizens do not speak it [CIA, Tuvalu].
- The labor force is largely uneducated and unskilled [CIA, Tuvalu].
- Air Fiji offers exclusive air service from Majuro, RMI and Fiji [Stanley, p. 536]. Connections with Continental Micronesia Airlines might be difficult.
- Fongafale has a short airfield that lacks the modern infrastructure of the airport at Kwajalein [CIA, Tuvalu].
- Tuvalu has fewer Western tourist amenities than more frequently visited island nations. There are no signs of golf or tennis [Stanley, p. 540].

3.4 Gan

3.4.1 Overview

Gan is an Indian Ocean island within the archipelago nation of the Maldives found southwest of India. The island of Gan is a part of Addu Atoll (also called Seenu Atoll). The entire Addu Atoll encompasses only 12 sq km. The atolls of the Maldives are some of the lowest in the world [CIA, Maldives]. The highest point in the entire country rises to no more than 2.4 m [CIA, Maldives]. The Dutch first took control of the storied Maldivian sultanate and later relinquished control to the British [CIA, Maldives]. The British built an air base on Gan in 1956 [Lyon, p. 171]. Close working relationships with the British encouraged the Ganese people to learn English [Lyon, p. 171]. To this day, the best English speakers in the country live in Addu Atoll and are quite accustomed to working for Westerners [Lyon, p. 171]. The British influence is not as strong in Male, the historic capital of the Maldives. The people of the Addu Atoll hold other cultural differences that have manifested themselves in a rebellious relationship at times [Lyon, p. 171]. Addu Atoll declared itself an independent republic in the late 1960s, but the government in Male quashed the uprising relatively quickly [Lyon, p. 171]. Today, the atoll is capitalizing on its history linked to the British [Lyon, p. 173]. A resort now operates on Gan where the old British military barracks formerly stood [Lyon, p. 173]. The Ganese people beckon Americans and Europeans to visit for tennis, diving, and military history [Lyon, pp. 172-173]. Before leaving the island, the British constructed a 16-km causeway that still forms the longest stretch of highway in the country [Lyon, p. 171]. The Gan airport is the second busiest in the country [Lyon, p. 171]. The runway stretches the span of the island (see Gan map). The British long ago cleared out the island's natural

lush vegetation [Lyon, p. 172]. Most recently the Maldives have shored communication by building a microwave satellite network of tall towers. In addition, the government has invested in a cellular-phone network to satisfy the desires of European and American tourists. Exorbitant prices of \$3.50/minute are paying for the improved national communication network and subsidizing its low rates of \$0.02/minute [The Economist, p. 51]. Available climatic data for Gan is limited. Weatherbase lists a single year of precipitation data for the island. Because of its southern hemisphere location, the island experiences a rainy season from January through March. Although a Library of Congress fact sheet on the Maldives suggests that the southern islands, of which Gan is a part, receive up to 3,800 mm of rainfall each year, the single year of data from weatherbase.com records only 2,400 mm, an amount lower than Kwajalein's average.

Location: 0.7 S 73.2 E



Figure 10. Gan (1976). The airfield spans the length of the island. Today it is the second busiest airport in the Maldives [University of Texas at Austin Library].

3.4.2 Advantages of Gan

- Gan is situated within Addu Atoll. The atoll's flat relief ensures minimal obstruction to radar beams.
- The atoll is promoting itself as a trendy new tourist destination with a half million visitors annually [*The Economist*, p. 51]. The Maldives archipelago is already an extremely popular diving destination. Though the Asian economic downturn slowed tourist growth, new resorts are springing up throughout the islands.
- The cell-phone network doubled the number of customers last year and boasts 10,000 customers in July of 2001 [*The Economist*, p. 51].
- When the British closed their military base on Gan, they left a long runway, a decent infrastructure for electricity, and a 16-km causeway connecting the islands of Addu atoll [*Lyon*, p. 171].
- The people of Gan and the Addu Atoll are a relatively skilled labor force accustomed to Westerners [*Lyon*, p. 171].
- More people speak English on Addu Atoll than in any other part of the Maldives [*Lyon*, p. 171].

- The currency has been frozen at the exchange rate of 11.77 Rufiyaa (Rf) to 1 \$U.S.

3.4.3 Disadvantages of Gan

- According to Library of Congress reports, rainfall in the southern islands of the archipelago reaches 3,800 mm per year, yet the report also describes rainfall as highly variable. Weatherbase's single year of data measured just 2,400 mm.
- Ill will between the residents of Addu Atoll and the central government in Male still lingers years after the rebellion in the 1960s [*Lyon*, p. 171].
- The Maldives' version of British common law is too conservative for the tastes of many Westerners.
- Jet service is only available via Air Maldives from Male [*Lyon*, p. 174]. Mail is accessible via Singapore Airlines from San Francisco, Hong Kong, and Singapore [*Singapore Airlines*]. Connections might be difficult.
- Freshwater aquifers are stressed, and most food for the country must be imported [*CIA*, Maldives].

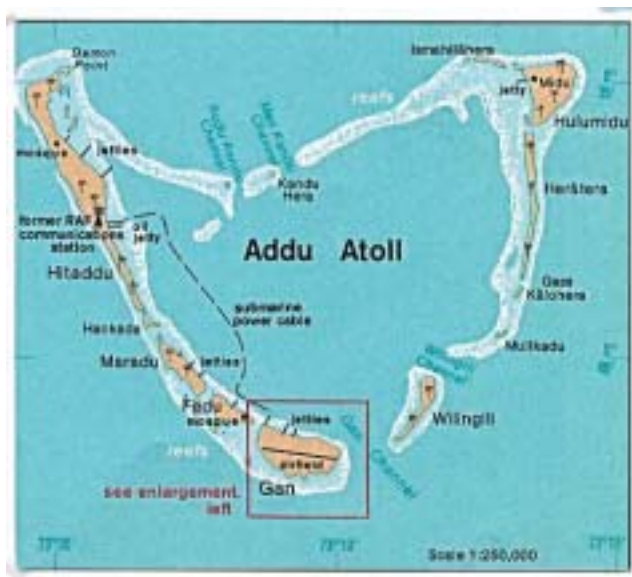


Figure 11. Addu Atoll (1976). Gan is the southernmost island of the atoll. Although not shown, a 16-km causeway connects Gan in the south to Hitaddu in the north-west [*University of Texas at Austin Library*].

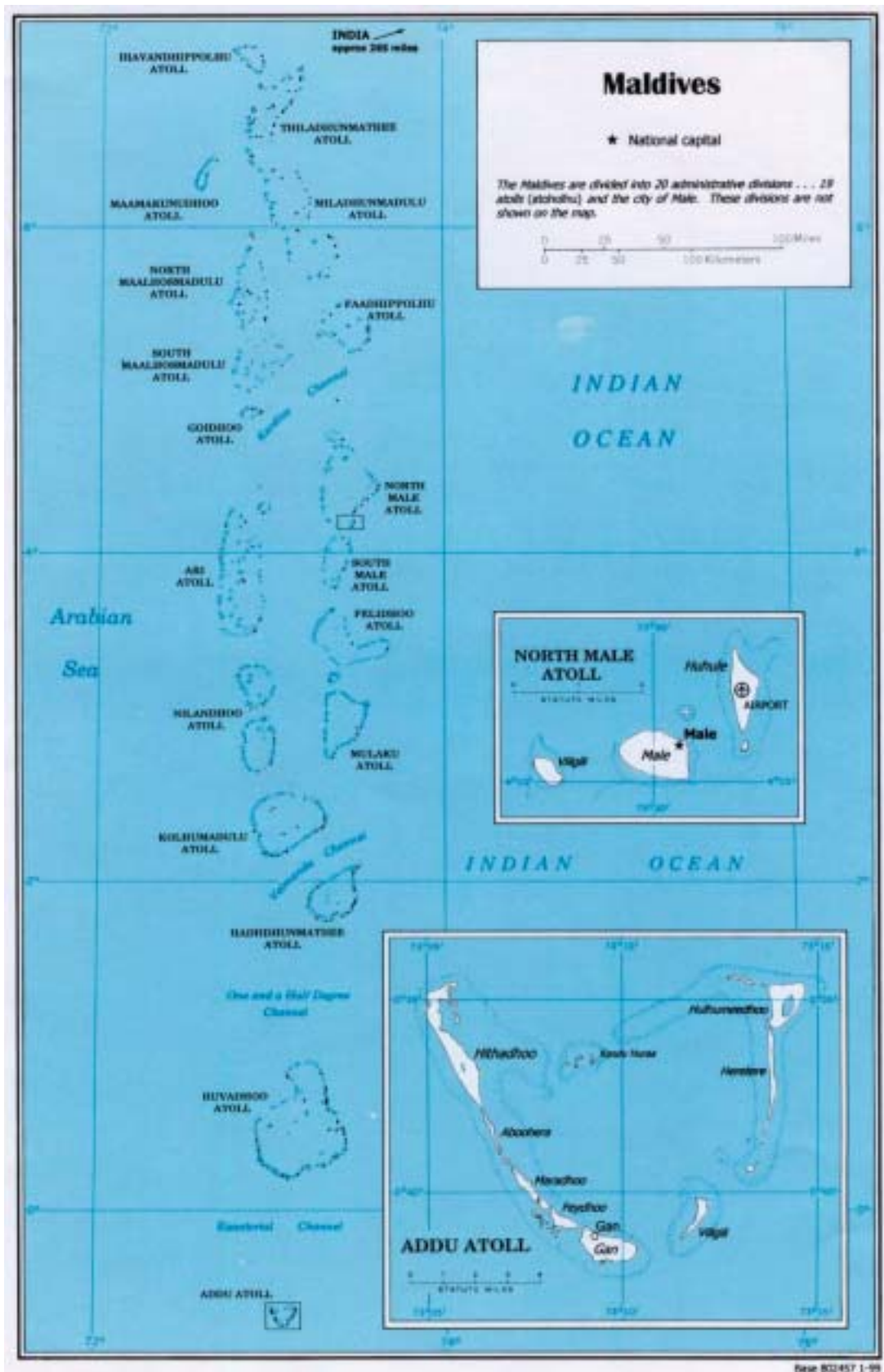


Figure 12. The Maldives (1999). Addu Atoll (also called Seenu Atoll) is the southernmost in a chain of atolls [University of Texas at Austin Library].

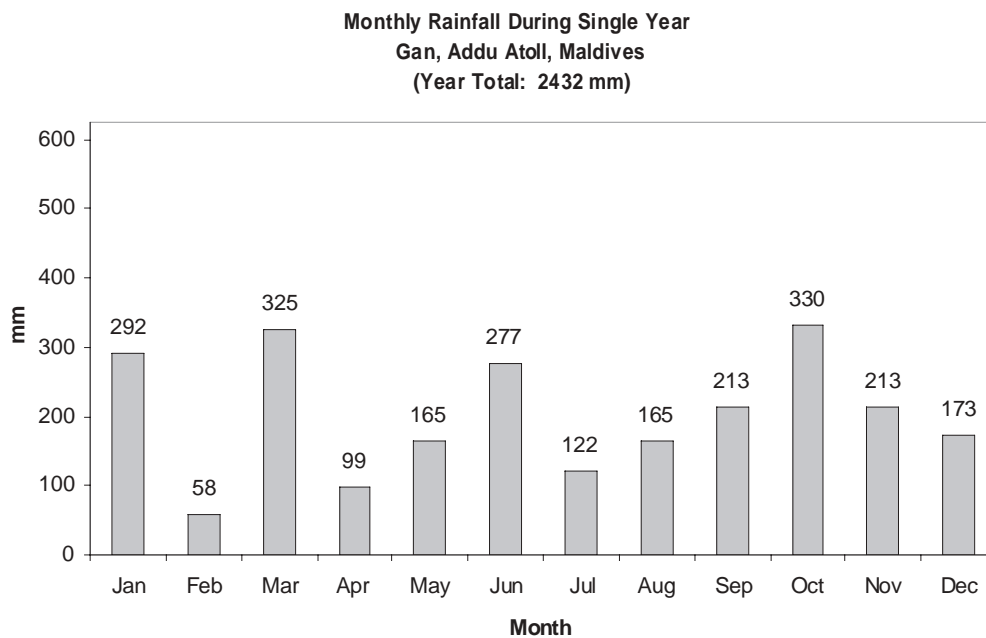


Figure 13. Rainfall for Single Year at Gan, Addu Atoll, Maldives [Weatherbase].

3.5 Key West

3.5.5 Overview

Key West is the last in a chain of low-lying islands known as “the Florida Keys,” stretching southwestward from the Florida peninsula of the United States. It is just 150 km north of Havana, Cuba and 175 km southwest of Miami. The entire island is no more than 7 sq km in size; the highest elevation is just 4 m above mean sea level [City of Key West]. Founded as an outpost to rid the area of pirates [City of Key West], Key West developed as an eccentric artist community. Many notable writers such as Ernest Hemmingway and Tennessee Williams made homes there [Straw]. The dominant industry on the island is tourism [City of Key West]. Because the island’s real estate is obviously limited, housing is extremely expensive. The National Association of Realtors lists Key West as the fourth most expensive housing market

in the U.S. [City of Key West]. A single road, US 51, connects Key West with the mainland. Key West is actually located north of the Tropic of Cancer and thus does not qualify as tropical. Key West’s average measurable rainfall pales in comparison to most of the other sites under review. (For example, Kwajalein: 2,600 mm, Key West: 1,000 mm) [Weatherbase]. Seventy-seven percent of Key West’s annual rainfall falls from May through November while 50 percent falls between June and September. Even with concentrated rainfall during part of the year, a typical wet month on Key West receives the same amount of rain as a typical dry month on Kwajalein. One of Key West’s most notable advantages is the NEXRAD S-band radar operating from Boca Chica on the Key West Naval Air Station. The naval air station provides more than sufficient infrastructure from which to base operations.

Location: 24.6 N 81.7 W



Figure 14. The Florida Keys of the United States (2000). Route One connects Key West to the Miami and the rest of the Florida Peninsula [The Insider’s Guide—Florida Keys and Key West].



Figure 15. *The Lower Florida Keys (2000). The Key West Naval Air Station lies mainly on Boca Chica Key, just to the northeast of Key West. The NEXRAD S-Band radar is located on Boca Chica Key [The Insider's Guide—Florida Keys and Key West].*

3.5.2 Advantages of Key West

- Key West is in the United States. There is greater familiarity with the procedures to expedite projects.
- NOAA already operates an S-band radar (KBYX) from Boca Chica Key as part of the NEXRAD weather radar network across the United States. A radar already in place is a significant advantage that potentially reduces costs.
- Key West provides American infrastructure. With Key West Naval Air Station and Key West International Airport, lack of support facilities will never be a problem. American infrastructure guarantees ample electricity and other utilities. Key West supermarkets and restaurants can accommodate a wide range of food diets.
- Key West is situated at the end of a low-lying chain of islands extending from the southern tip of the Florida peninsula. Therefore, the radar site would provide a decent swath of precipita-

tion systems over open waters. Towers would form the only major obstructions.

- Key West is not in the tropics, but just north at latitude 25 N. The more northerly latitude might increase the frequency of satellite overpasses.
- A relatively high-skilled labor force resides in the Florida Keys compared to the Pacific islands under consideration.

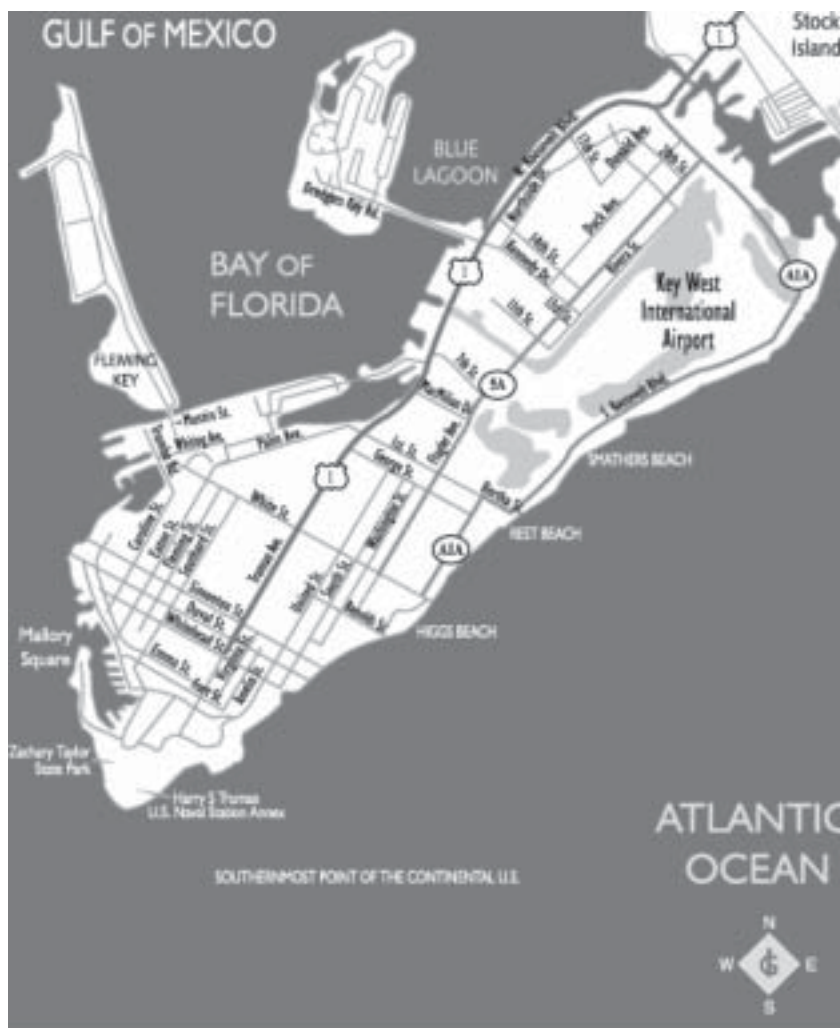
3.5.3 Disadvantages of Key West

- NASA would have no control over the radar operations or scan strategy of the NOAA radar.
- Key West receives on average 1,000 mm of rainfall per year, far less than Kwajalein's 2,600 mm [NCDC and Weatherbase].
- Despite being a more convenient location for American researchers, the cost of living in Key West is expensive, compared to the other islands under consideration. According to one

source, Key West has the highest cost of living in all the state of Florida [*The Insider's Guide: Florida Keys and Key West*]. However, this expense might be offset somewhat by cheaper transportation costs. Food and merchandise is generally higher than on the mainland because all goods must be shipped into the small town.

- Any hourly labor support for the project will cost more in Key West than at any other site.

Figure 16. Key West, Florida (2000). The airport is on the eastern edge of the island [*The Insider's Guide—Florida Keys and Key West*].



Average Monthly Rainfall
Key West, Florida, USA
(Annual: 1005 mm)

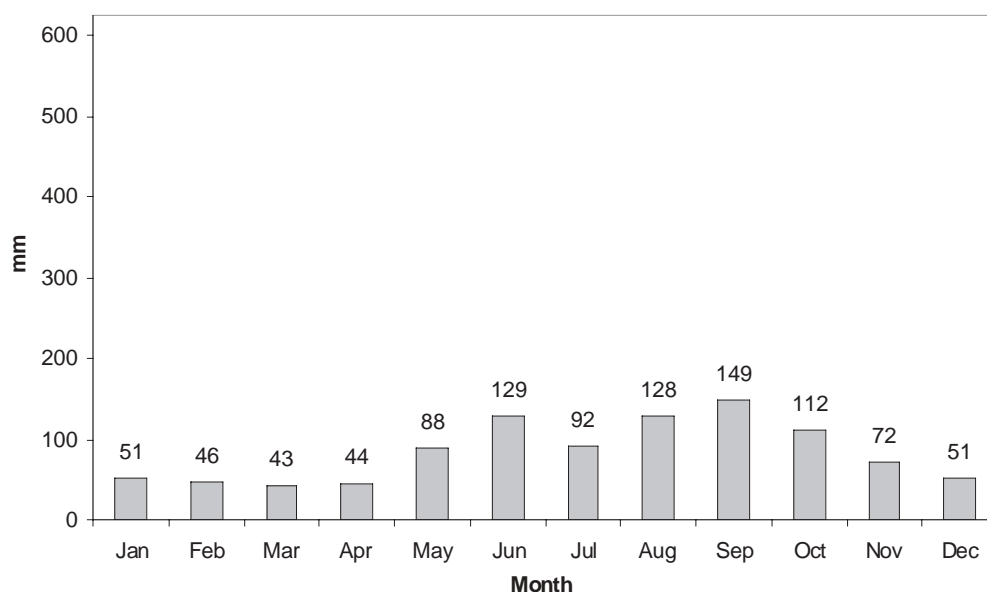


Figure 17. Rainfall for Key West, Florida [NCDC].

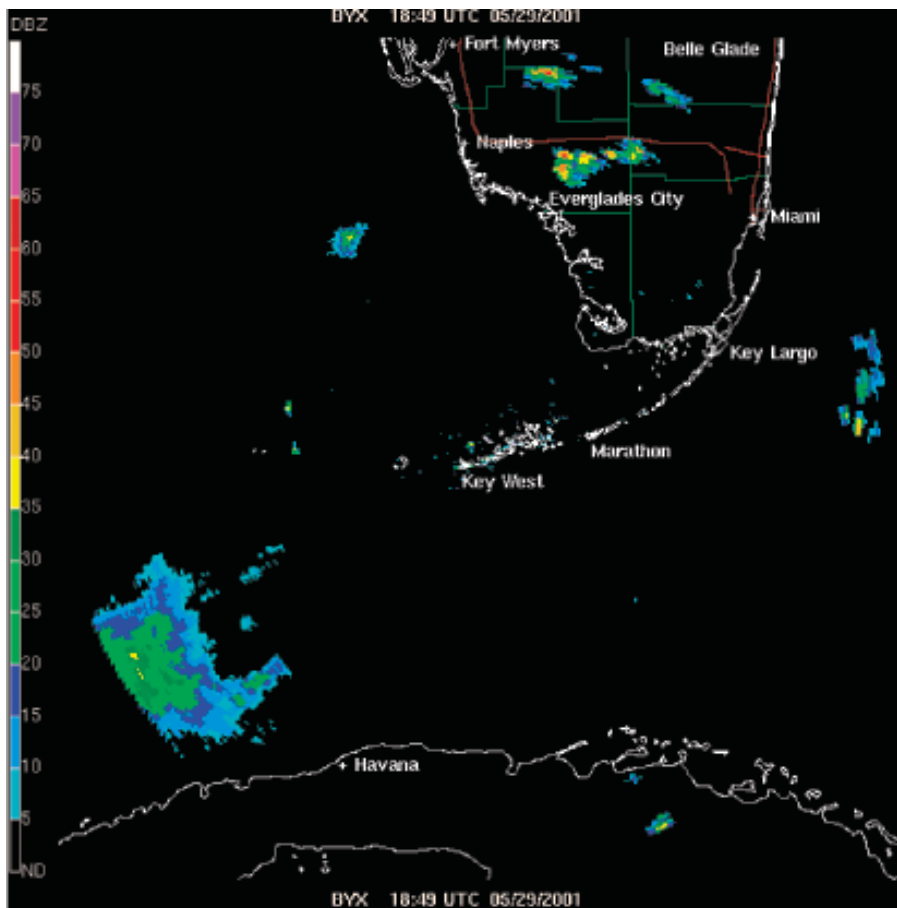


Figure 18. This is an image from the NEXRAD radar KBYX at the Key West Naval Air Station on Boca Chica Key. Florida is to the north. Cuba is to the south [NOAA].

Average Number of Days with Precipitation > 0.25 mm
Key West, Florida, USA
(average days / year: 108)

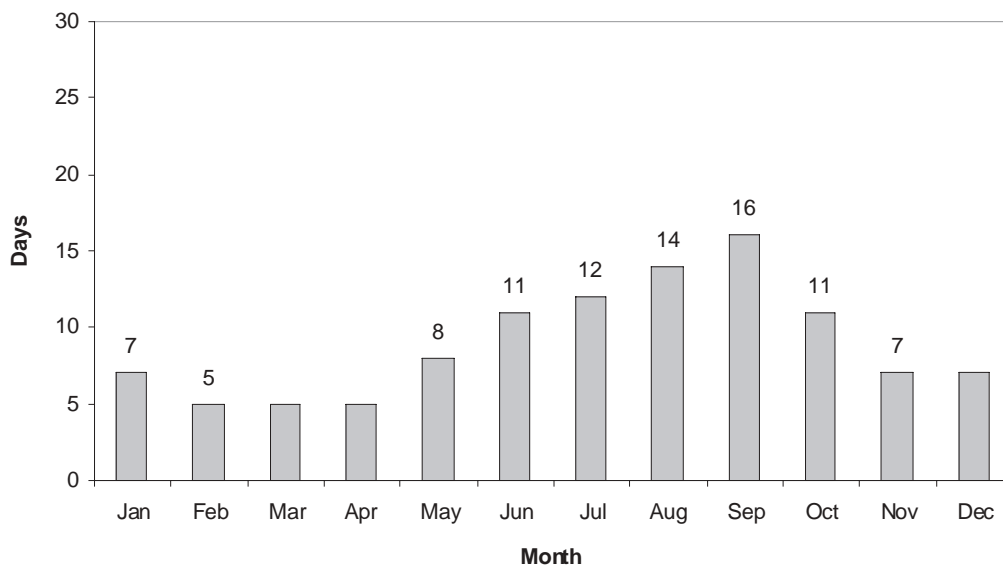


Figure 19. Average frequency of rainfall in each month for Key West, Florida.

3.6 Kiriritimati

3.6.1 Overview

Kiritimati is the largest island in the country of Kiribati. The island nation of Kiribati straddles the equator and is situated halfway between Hawai'i and Australia. Kiritimati is situated on the eastern periphery of the island nation. The island's 420 sq km account for over half of the country's land area [Resture, Christmas History]. The island is a low-lying atoll with minimal relief [Resture, Christmas History]. For most of the twentieth century, Kiritimati was under British control and called Christmas Island. After World War II, the British selected Christmas Island as their hydrogen bomb testing site [Resture, Bomb]. At the time evacuation of the native population was not considered necessary, but precautions dictated that women and children be transferred temporarily to nearby Fanning Island [Resture, Bomb]. The British conducted nuclear testing from November 1957 to September 1958 [Resture, Bomb]. The Americans followed up with nuclear testing on the island from April to July 1962 [Resture, Bomb]. An American report on behalf of the Japanese in 1975 declared that radiation levels on Christmas Island were lower than most American cities [Resture, Bomb]. The Japanese then constructed a space tracking station on the island [Resture, Bomb; Levy, p. 274]. In 1979 the British relinquished title to the nation of Kiribati. The Kiribati government changed the name back to Kiritimati. Despite the existence of some infrastructure on the island due to British and American nuclear testing as well as the Japanese satellite tracking station, the island receives less than 650 mm of rain in most years and cannot be considered a suitable site for studying tropical precipitation [Weatherbase].

Location: 2.0 N 157.0 W



Figure 20. Kiribati (2000). Kiritimati lies in the eastern region of the island nation [University of Texas at Austin Library].



Figure 21. Kiritimati (Christmas Island) (unk). Weather records for the island were taken at Main Camp [Resture, Bomb].

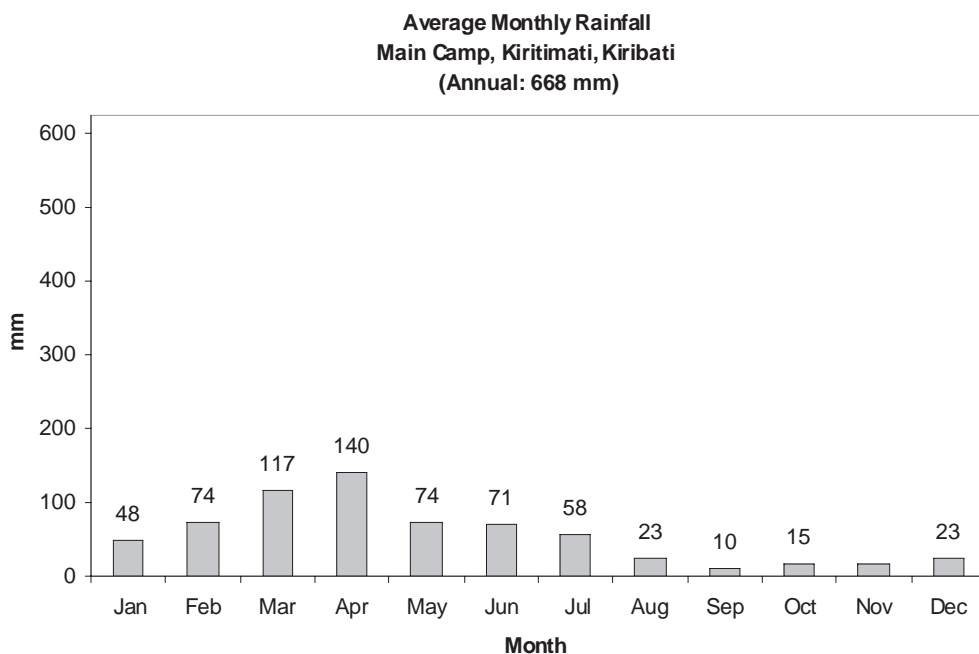


Figure 22. Rainfall for Main Camp, Kiritimati, Kiribati [Weatherbase].

3.6.2 Advantages of Kiritimati

- The British constructed a large airfield on the island to go along with the nuclear testing facility.
- The National Space Development Agency of Japan NASDA maintains a tracking facility on the island [Levy, p. 274] and provides evidence of a reliable supply of energy.
- Kiritimati provides an inexpensive source of labor.

3.6.2 Disadvantages of Kiritimati

- Kiritimati receives insufficient rainfall for a tropical precipitation study. In the last decade, rainfall has been averaging close to 500 mm per year [Resture, Christmas], even less than its more long-term, official average rainfall per year of 650 mm [Weatherbase].
- No commercial air service serves Kiritimati. Aloha Airlines charts planes from Hawai'i [Aloha Airlines Interview].
- Freshwater supplies are dwindling [Resture, Christmas].
- Kiritimati's labor force is largely uneducated and unskilled [CIA, Kiribati].
- Kiritimati's central government is located hundreds of km away on Tarawa Atoll. This might further impede dealings with an already antiquated governmental bureaucracy.
- There may be difficulties in convincing researchers to work on an island that once hosted nuclear testing.

3.7 Koror

3.7.1 Overview

The islands of Palau are located in the North Pacific Ocean, three quarters of the way from Hawai'i to the Philippines. The entire country covers 458 sq km, most of it part of the island of Babelthaup [CIA, Palau]. Koror itself is much smaller, covering less than 10 sq km. Nearby elevations reach 200 m above mean sea level (see maps). Palau gained its independence in 1994 from the United States and became a republic [CIA, Palau]. The island ratified a Compact of Free Association with Washington in 1993 [CIA, Palau]. In return for certain aid packages, the U.S. stipulated in the treaty that it has the right to construct a military base if the need ever arises [CIA, Palau; Bendure and Friary, p. 200]. Ever since the agreement was signed, the Palau government has been casting a wary eye towards the possibility of the U.S. abandoning military bases in the Philippines and Japan. Unlike most of the other former American possessions in Oceania, Palau lies strategically close to American interests in Asia. Koror has always been the main administrative and trade center for Palau [Bendure and Friary, p. 203]. During World War II, the Japanese administered all of its Pacific possessions from Koror [Bendure and Friary, p. 198]. By the 1930s, they had transformed the village into a small city, complete with electricity and running water [Bendure and Friary, p. 198]. Today it is a town of around ten thousand, roughly two-thirds of all of Palau's population [Bendure and Friary, p. 203]. Just to the north of Koror is the hilly large island of Babelthaup with peak elevations surpassing 200 m. A floating bridge connects Koror to Babelthaup and Palau's airport, which is at the southern end of Babelthaup [Levy, p. 169]. The agreement with the U.S. guaranteed generous aid packages for 15 years [Bendure and Friary, p. 201]. Much of it is used for infrastructure development [Bendure and Friary, p. 201]. However, the island suffers from a bloated bureaucracy with 16 states, many with less than a hundred citizens [Bendure and Friary, p.

201]. Each state has a governor, a legislature, and a supreme court [Bendure and Friary, p. 201]. Palau is one of the world's great diving sites and the nation has placed great emphasis on Asian tourism [Bendure and Friary, p. 196]. With the economic downturn in Asia, the nation has begun marketing the U.S. as well [CIA, Palau]. Solid waste disposal is a recurring problem [CIA, Palau]. A new capital is being constructed on Babelthaup 20 km northeast of Koror [CIA, Palau]. Palau has a high per capita GDP (\$8,800) because of both East Asian tourist income as well as the abundance of natural resources uncommon to other Pacific islands [CIA, Palau]. Palau recently began using satellite communications [CIA, Palau]. On average Palau receives copious amounts of rain each year (3,800 mm). Fifty-one percent of the precipitation falls between June and October. Seventy-five percent of the precipitation falls between May and December (NCDC).

Location: 7.5 N 134.5 E



Figure 23. Palau (1970). Koror is a tiny island just to the southwest of the large island of Babelthaup [University of Texas at Austin Library].



Figure 24. The City of Koror on Koror Island (1983). Weather records were taken from inside the city of Koror on a 30-m hill overlooking the water. Bridges connect Koror Island and the city to other island suburbs to the west. To the northeast a modest pontoon floating bridge (not shown) has replaced the architecturally impressive K-B bridge (shown) which collapsed in 1996 for unknown reasons (Levy, p. 169). The unpopulated small islands with steep relief to the south of the city are the northern extension of the Rock Islands [University of Texas at Austin Library].



Figure 25. Southern Babelthau Island (1983). The K-B bridge (in the west on this map) spanned Koror Island and the city with the suburbs and Palau Airport on the big island of Babelthau before it collapsed in 1996. Today a floating pontoon bridge has been erected in its place (Levy, p. 169) [University of Texas at Austin Library].

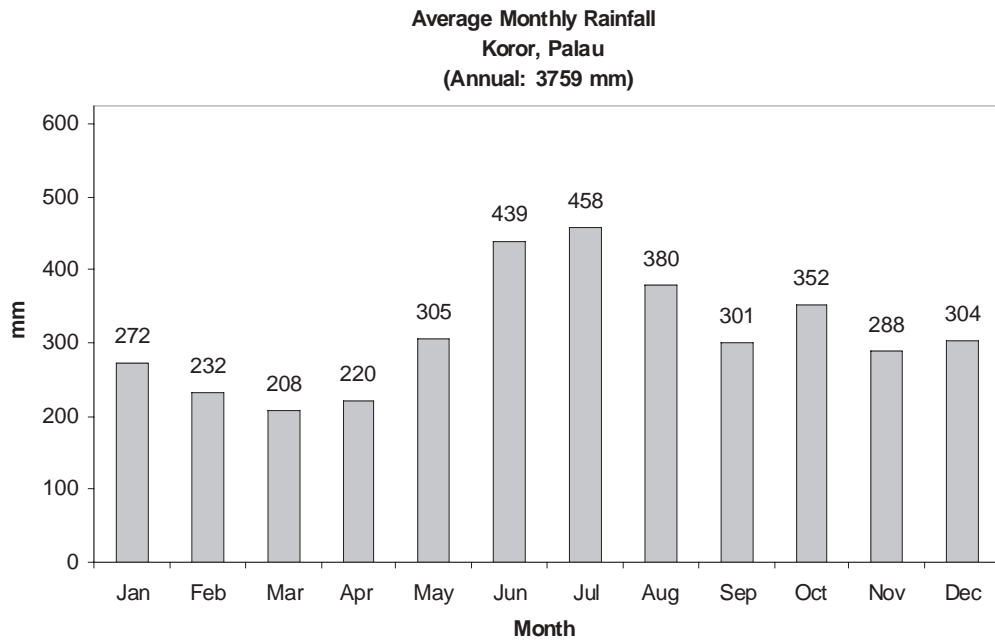


Figure 26. Rainfall at Koror, Palau [NCDC].

3.7.2 Advantages of Koror

- Palau receives heavy annual rainfall, on average 3,800 mm per year (Kwajalein 2600 mm yearly). The rainy season extends from May to December. The weather station is situated on a low hill on the southern side of Koror. On average March is the driest month with 208 mm of rainfall (NCDC and Weatherbase).
- English is one of the official languages (CIA, Palau).
- The government holds close ties to the U.S. (CIA, Palau).
- Palau offers a diverse array of recreational amenities including golf, tennis, and reputedly the world's best diving (Bendure and Friary, pp. 196, 207).
- Palau's per capita GDP of \$8,800 ranks highest against all sites being considered except Key West (CIA, Palau).

- Continental Micronesia serves Palau from Honolulu via Guam (Continental Airlines).
- The U.S. dollar is used as currency (CIA, Palau).

3.7.3 Disadvantages of Koror

- The island has experienced some corruption problems in its oversized government.
- Although American aid packages were designed to improve basic infrastructure, there are recurring problems. Water supplies are not always constant (CIA, Palau).
- The nearby island of Babelthaup does rise above 200 m in some spots. It is also a large island, the largest in Micronesia outside of Guam. The size will certainly reduce marine radar coverage.

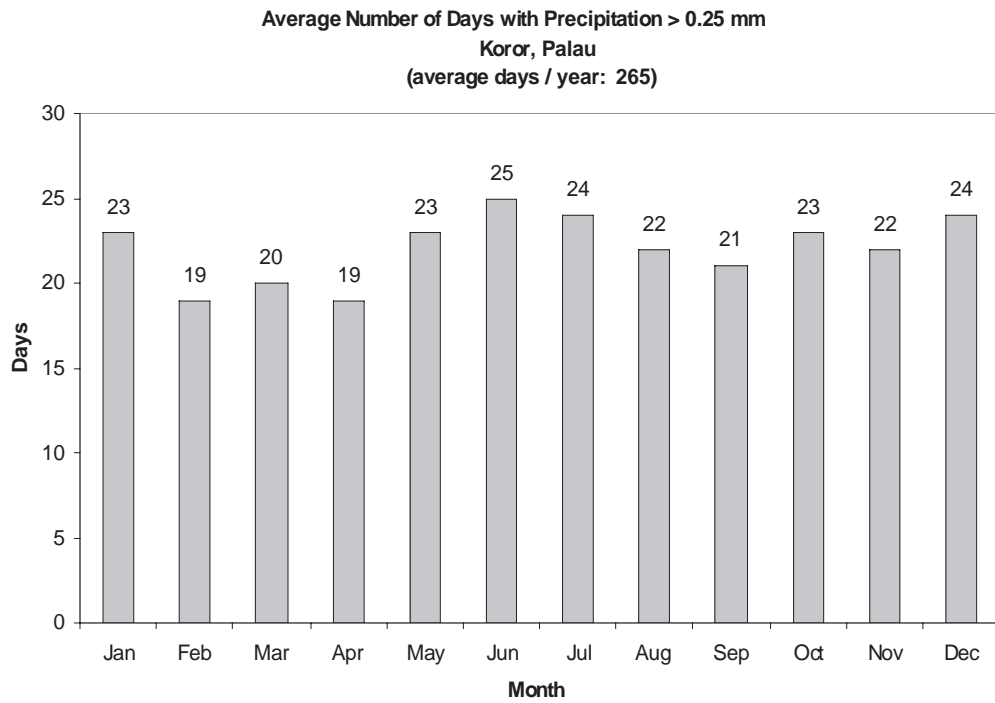


Figure 27. Average frequency of rainfall for Koror, Palau [NCDC].

3.8 Kosrae

3.8.1 Overview

Kosrae is one island in the Federated States of Micronesia (FSM or simply Micronesia), an island nation in the North Pacific three quarters of the way from Hawai'i to Indonesia. The island of 109 sq km is volcanic in origin with a rugged mountainous center reaching 629 m above mean sea level [Bendure and Friary, p. 105]. Kosrae and the FSM were formerly under American protection. In 1986, Micronesia ratified a Compact of Free Association with the US and became independent [CIA, FSM]. Kosrae is the smallest state in the FSM. It is also arguably the most isolated; the island is situated at the eastern end of the ocean nation. The airport is constructed from landfill that juts away from the island's shores along the northwestern side. Today it is accessible via the ring road to the capital center on the east side of the island. Although the island receives large

amounts of rainfall, poor infrastructure fails to translate the abundance of rainwater into healthy drinking water [Bendure and Friary, p. 119]. Out of the four states of the FSM, Kosrae continues to be the one least visited; therefore, tourist facilities are much less developed [Bendure and Friary, p. 119]. Kosrae's most notable advantage is the abundant rainfall that it receives on an annual basis. On average the island's airport records over 4,500 mm of rainfall each year (NCDC). Much of the rainfall must be attributed to orographic enhancement associated with the island's mountainous center. However, the island does lie at 5 degrees north latitude and taps the ITCZ's belt of moisture more reliably than Kwajalein. February, the driest month, receives on average 335 mm, more than the wettest month of October for Kwajalein with 303 mm (NCDC).

Location: 5.2 N 162.6 E



Figure 28. Kosrae (unk.) [Resture, Kosrae].

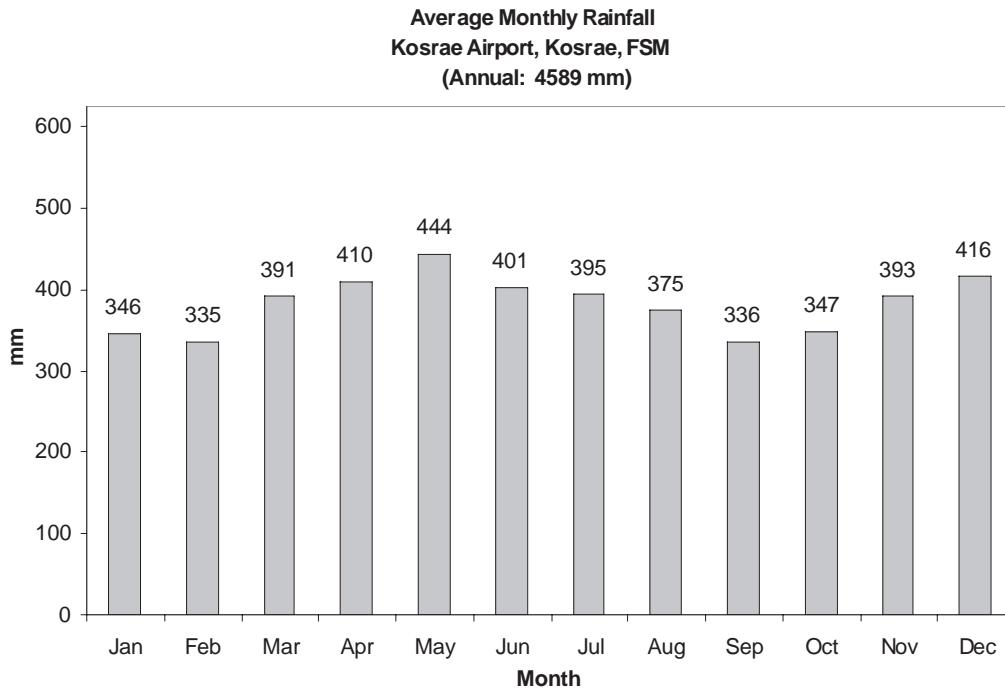


Figure 31. Rainfall for Kosrae, FSM [NCDC].

3.8.2 Advantages of Kosrae

- According to the NCDC, Kosrae receives close to twice the amount of rainfall as Kwajalein (Kwajalein: 2,600 mm, Kosrae: 4,600 mm). In addition, Kosrae experiences no distinct dry season, making it suitable for year round monitoring.
- The entire FSM experiences high unemployment; therefore, wages are extremely low [CIA, FSM].
- The FSM's Compact of Free Association with Washington guarantees relatively good governmental ties between the two countries.
- Kosrae is not as crowded as other Pacific islands and therefore might offer more radar site options.
- English is an official language [CIA, FSM].

- Air transportation is provided direct from Honolulu via Continental Micronesia [*Continental Airlines*]. Although the runway is not terribly long, it is sufficiently long for support aircraft.
- The FSM uses U.S. currency [CIA, FSM].

3.8.3 Disadvantages of Kosrae

- The island suffers from poor infrastructure such as electricity and communication. The water is undrinkable [Bendure and Friary, p. 119].
- Any radar site on the island is likely to encounter up to a 25 percent reduction in coverage area because of 600-m high Mt. Finkol at the center.
- Kosrae is isolated from the rest of Micronesia and is the least populated; therefore, the national government often ignores its issues.

3.9 Kwajalein

3.9.1 Overview

Kwajalein Atoll is part of the Republic of the Marshall Islands (RMI). The nation is a group of atolls that lie halfway between Hawai'i and Papua New Guinea. The island of Kwajalein is less than 15 sq km in size and the highest point is less than 10 m above mean sea level. Kwajalein Island is the southernmost island of the Kwajalein Atoll, the world's largest [Bendure and Friary, p. 89]. Formerly an American protectorate, the RMI entered into a Compact of Free Association with the United States upon independence in 1986 [CIA, RMI]. The agreement guaranteed the continued American use of the Kwajalein Missile Range (KMR) of the U.S. military [Bendure and Friary, p. 76]. Today, the range extends over several islands in the Kwajalein Atoll. The U.S. military regularly tests weapons over the lagoon [Bendure and Friary, p. 89]. KMR hosts American civilian contingents from several companies involved in weapon research and development [Bendure and Friary, p. 89]. Approximately 10,000 Marshallese reside in a settlement on the smaller island of Ebeye, just to the northeast of Kwajalein [Bendure and Friary, p. 90]. Each morning, hundreds of Ebeye residents commute by boat across the channels of the lagoon to Kwajalein where they hold service jobs on the base [Bendure and Friary, p. 90]. Life on Kwajalein in many ways resembles life on a U.S. military post [Bendure and Friary, p. 90]. The island has its own American school, commissary, infirmary, post office, and recreational facilities [Bendure and Friary, p. 90]. Researchers have conducted meteorological experiments from KMR for several years now, most recently with KWAJEX. The atmospheric science research teams have forged a relationship with Aeromet, a company contracted to forecast weather for the Army and FAA activities based in the atoll. Aeromet provided forecast and technical support for KWAJEX. Kwajalein receives on average close to 2,600 mm of rainfall each year [NCDC]. Its location at 8.5 degrees north latitude is just north of the ITCZ's climatological belt of

heavy rainfall. The precipitation is highly seasonal. Seventy-three percent of the island's precipitation falls between May and November.

Location: 8.7 N 167.7 E

3.9.2 Advantages of Kwajalein

- Kwajalein receives on average almost 2,600 mm of rainfall yearly [NCDC].
- Kwajalein has a permanent S-band dual polarization Doppler radar facility originally developed for Army and FAA applications and recently upgraded by NASA for TRMM Ground Validation applications.
- Aeromet and the U.S. Army have been very cooperative regarding NASA Ground Validation needs. The current nominal scan strategy for the radar was developed to optimize Army, FAA, and NASA Ground Validation applications for the radar data and has significantly higher vertical resolution than the NEXRAD scans.
- Meteorological researchers have a history working on Kwajalein. Radar projects have been conducted on the island a number of times in the past. Researchers are familiar with the area—both its strengths and weaknesses as a place to live and work. Researchers maintain contacts with individuals and institutions on the island.
- The island is situated at the southern end of a low-lying atoll that provides minimal topographical interference with the radar beam. The only exceptions are towers. Radar coverage can span 360 degrees and is virtually unimpaired over marine waters.
- The Kwajalein Missile Range supports weapons testing by the U.S. Government. For this reason, the U.S. Government ensures reliable energy sources, transportation, communications, food safety, and good drinking water.

- The island is entirely inhabited by American contract workers, American military personnel, and their dependents. All speak English.
- The island is easily accessed by Continental Micronesia's Oceania route from Honolulu to Majuro, RMI and on to Kwajalein [*Continental Airlines*]. Aloha Airlines just initiated direct service from Honolulu with weekly flights [*Aloha Airlines*]. The U.S. military operates flights to Kwajalein from Hickam AFB in Honolulu several times a week nominally and more frequently associated with missile tests.
- The island of Ebeye, just northeast of Kwajalein, sends hundreds of workers each day in order to provide service-type work for low wages [*Bendure and Friary*, p. 90].

3.9.3 Disadvantages of Kwajalein

- In past experiments, the most intense storms lie just south of the Kwajalein-based radar's range. Although rainfall is plentiful (2,600 mm of rainfall on average per year), the island is just to the north (around 8 N) of the ITCZ's zone of heavy precipitation (around 5 N).
- The island's military character and small size limit recreational possibilities.

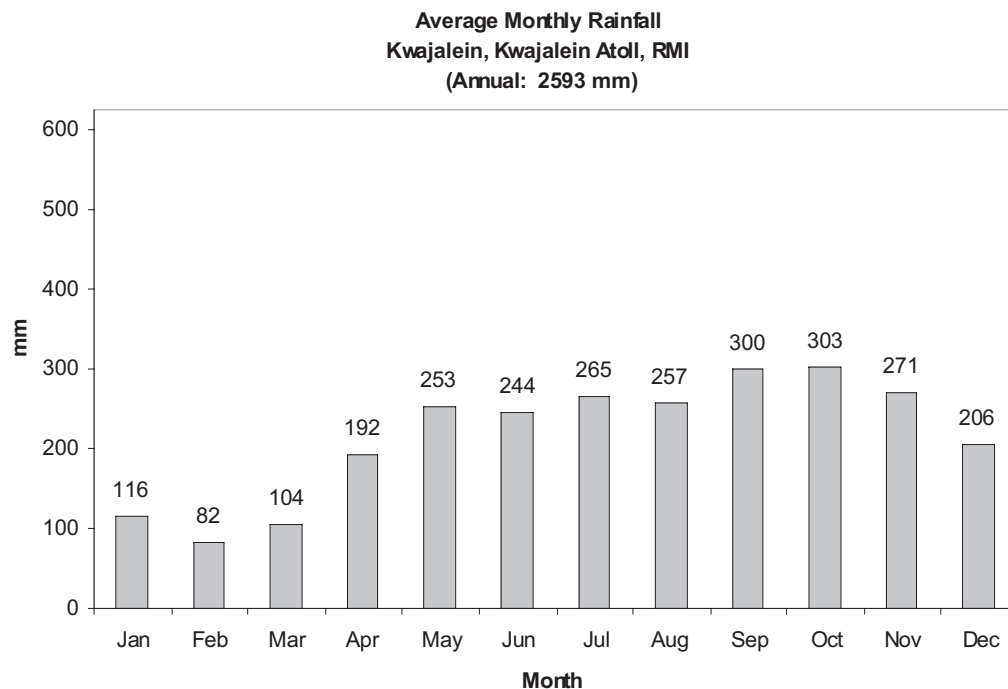


Figure 32. Rainfall for Kwajalein Island, RMI [NCDC].

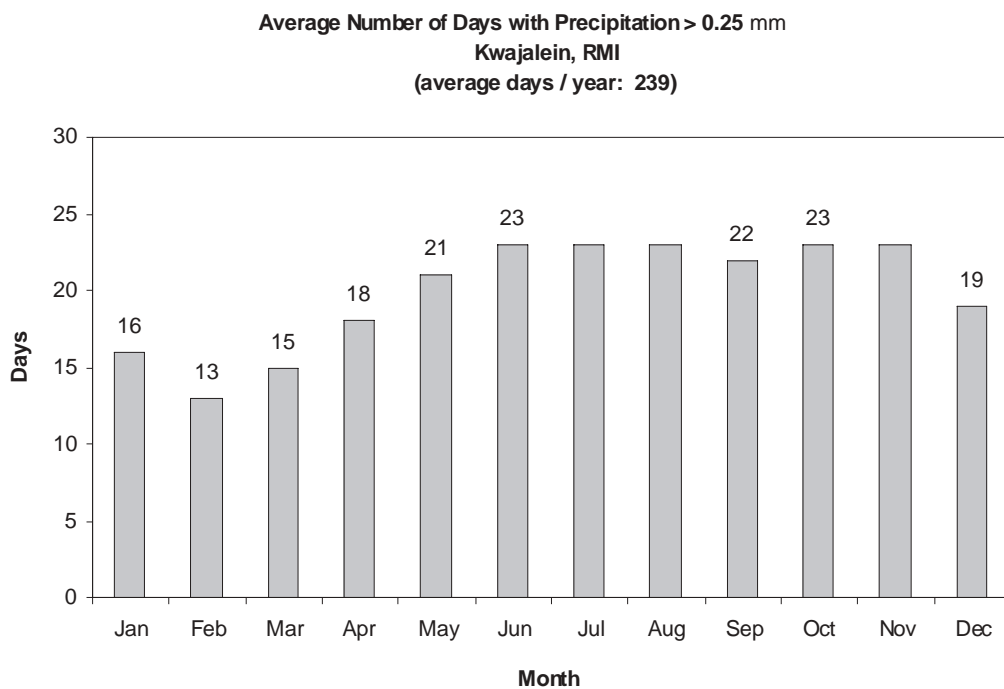


Figure 34. Average Frequency of rainfall for Kwajalein, RMI [NCDC].

3.10 Pohnpei

3.10.1 Overview

Pohnpei is one island in the Federated States of Micronesia (FSM or simply Micronesia), an island nation in the North Pacific three quarters of the way from Hawai'i to Indonesia. Within the state of Pohnpei, Pohnpei Island is the largest in the FSM covering 334 sq km [Bendure and Friary, p. 123]. The volcanic mountainous center has peaks exceeding 700 m [Bendure and Friary, p. 123]. Pohnpei and the FSM were formerly under American protection [CIA, FSM]. In 1986 Micronesia ratified a Compact of Free Association with Washington and gained independence [CIA, FSM]. Like Yap, Pohnpei's state government has trended towards responsible budgeting, and therefore, the island is doing much better economically than Chuuk [FSM government]. In addition, the FSM located the national capitol and national university on the island [Levy, p. 96]. With Pwisehn Malek mountain forming an unforgettable backdrop, the

sprawling campuses form the modern showcases of the young nation [Levy, p. 102]. Both were located in Palikir just 8 km southwest of the state capital of Kolonia to encourage development outside the Kolonia urban center [Levy, p. 102]. As the seat of the national government, the island attracts many internationals. Pohnpei hosts a large American expatriate population involved in education and missionary work [Levy, p. 96]. Pohnpei averages an amazing 4,700 mm of rainfall per year [NCDC]. Dry months on Pohnpei are comparable to a wet month for Kwajalein. Pohnpei lies within the ITCZ belt of heavy precipitation near 5 degrees N. However, the high mountainous center will limit potential radar coverage significantly. In addition, the size of the island (radius of 18 km) will yield a combination of radar coverage over land, coast, and open ocean.

Location: 7.0 N 158.0 E



Figure 35. Pohnpei, FSM (unk). Kolonia, the state capital, and Pohnpei Airport are in the north. The national capitol campus and the national university are located in Palikir, 8 km southwest of Kolonia [FSM Government].

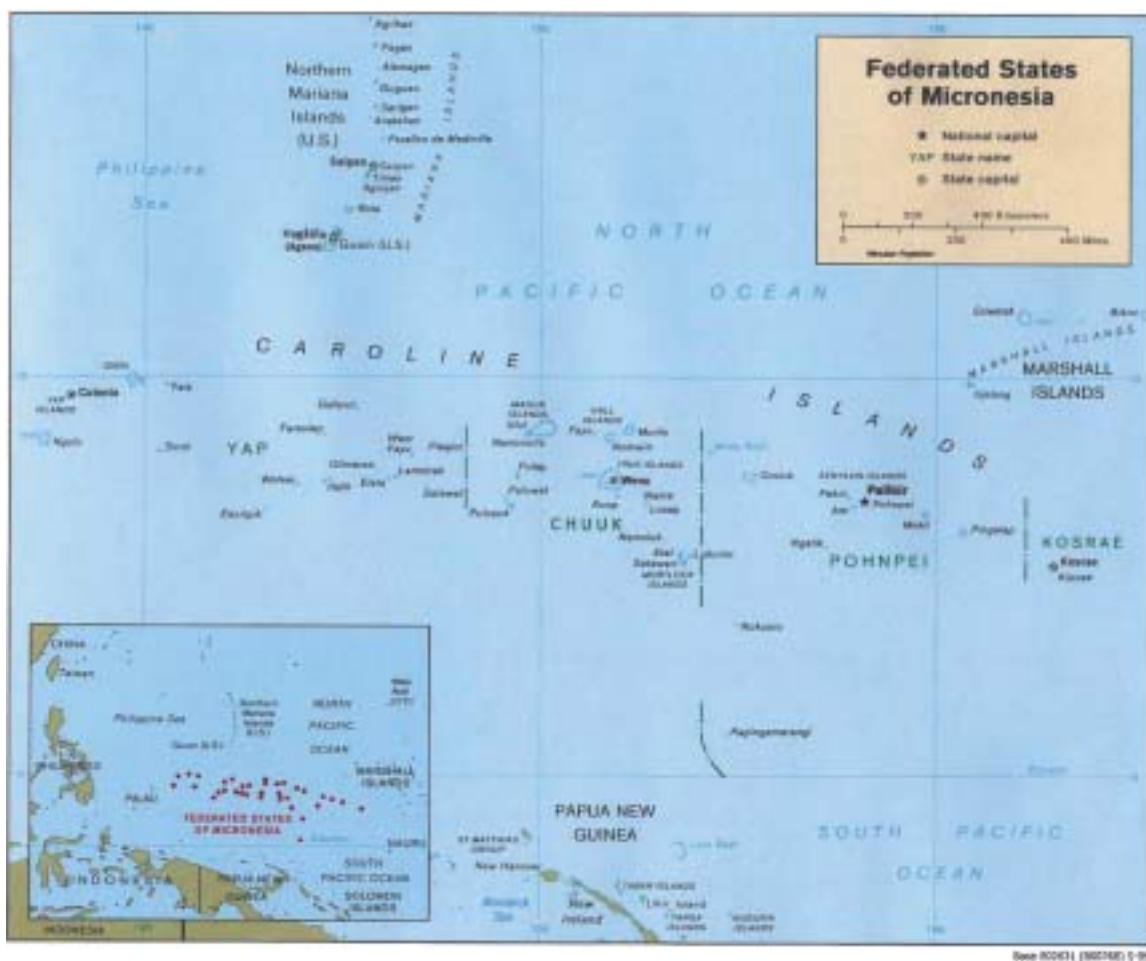


Figure 36. The FSM (1989). Pohnpei lies in the east central part of the island nation. The village of Palikir on the island of Pohnpei is the capitol of the FSM [University of Texas at Austin Library].

3.10.2 Advantages of Pohnpei

- Pohnpei receives on average over 4,700 mm of rainfall per year. Its position in the track of easterly waves within the ITCZ is favorable for heavy rainfall. Heavy precipitation is year-round [NCDC].
- The capitol of the FSM was constructed recently in Palikir, on the northwestern side of the island [Levy, p. 96]. Its location on Pohnpei would seem to favor Pohnpei over Truk, Yap, and Kosrae in terms of infrastructure development. As a general rule, capitols receive more funds for development than provincial areas.
- The island is large and diverse enough to accommodate a broad range of tourism-related activities, including hiking, diving, and biking [Bendure and Friary, pp. 126-127].
- Transportation to Pohnpei is available via Continental Micronesia's Oceania route from Honolulu via both Guam and Chuuk to Pohnpei [Continental Airlines].
- In addition to high unemployment throughout the FSM, Pohnpei is home to the College of Micronesia in Palikir [Levy, p. 96]. Students and alumni of the school can supply both inexpensive and relatively educated labor sources.

- The official currency is the U.S. dollar [CIA, FSM].
- English is one of the official languages in Pohnpei [CIA, FSM].
- The mountainous center of the island will limit marine radar coverage to a significant extent. The mountainous peaks in the center of the island surpass 700 m in elevation.
- On the whole the FSM has a poorly developed infrastructure. Even though Pohnpei might be favored above other Micronesian states, its energy infrastructure is still deficient. Only urban areas have sewer systems [CIA, FSM].

3.10.3 Disadvantages of Pohnpei

- Topography dramatically enhances precipitation on the island. Such orographic precipitation is not representative of open ocean precipitation.

Figure 37. Rainfall for Kolonia, Pohnpei [NCDC].

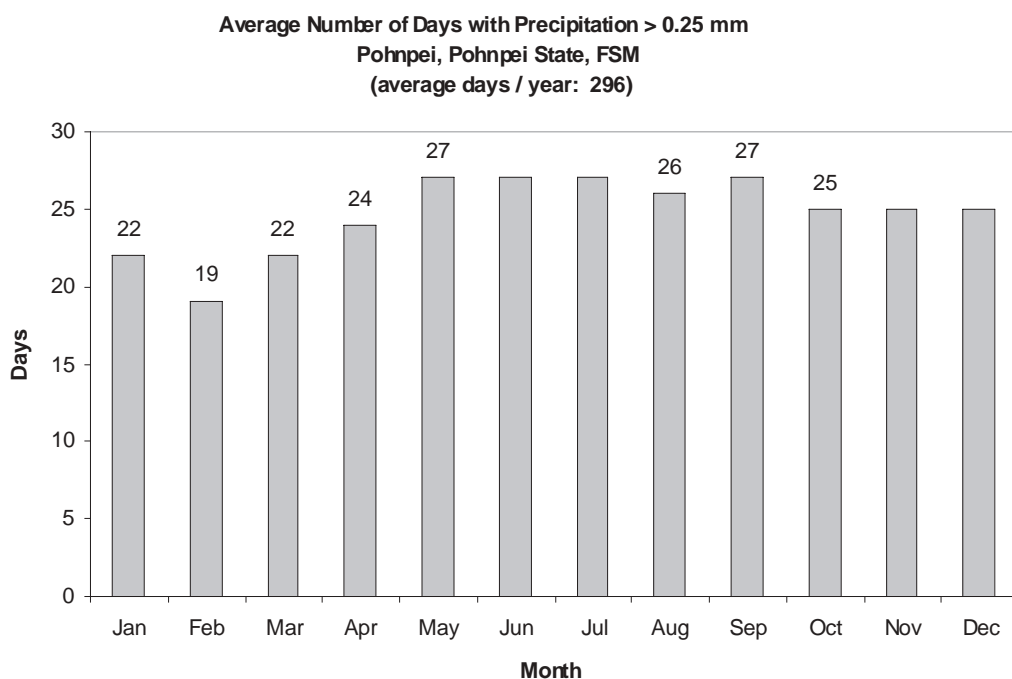
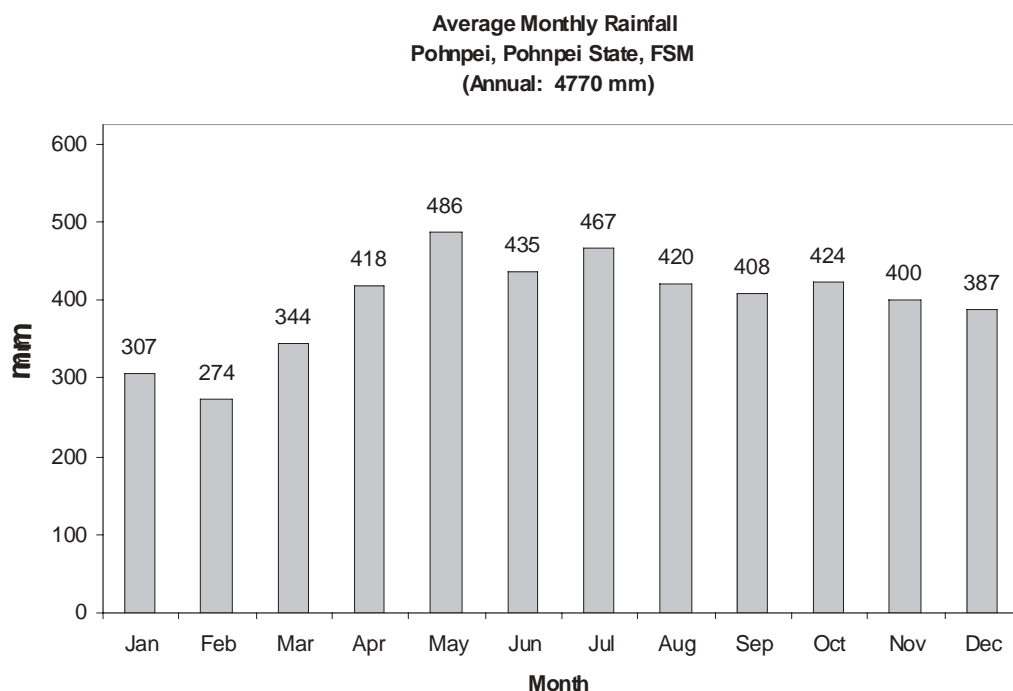


Figure 38. Average frequency of rainfall for Pohnpei, FSM.

3.11 Temaiku

3.11.1 Overview

Temaiku is the largest island of Tarawa Atoll in the island nation of Kiribati. Kiribati straddles the equator, halfway between Hawai'i and Australia. The atoll covers 26 sq km and has a peak elevation of no more than 5 m. Kiribati gained independence from the UK in 1979 [CIA, Kiribati]. Tarawa Atoll was made the seat of government [CIA, Kiribati]. The main urban center and the airport are located on Temaiku. A causeway connects Temaiku with the rest of the atoll's urban centers [Stanley, pp. 838, 840]. One of the main issues with Tarawa Atoll is overcrowding [CIA,

Kiribati]. Heavy pollution is widespread [CIA, Kiribati]. Traditional practices such as lagoon latrines and open-pit dumping place ground water at risk [CIA, Kiribati]. Tourism represents one-fifth of the GDP, but pollution threatens to all but eliminate it [CIA, Kiribati]. Weak infrastructure, a shortage of skilled laborers, and inaccessibility all hamper development prospects [CIA, Kiribati]. Weatherbase estimates precipitation at 1,900 mm per year.

Location: 1.3 N 173.0 E



Figure 39. Kiribati (2000). Tarawa Atoll and Temaiku Island are located in the western part of the island nation, just north of the equator [University of Texas at Austin Library].



Figure 40. Tarawa Atoll and Temaiku Island (unk). Temaiku Island is the main urban center of Tarawa Atoll. It is the easternmost island of the atoll [Resture, Tarawa].

3.11.2 Advantages of Temaiku

- Tarawa is an atoll with minimum radar interference.
- English is one of the official languages [CIA, Kiribati].
- Tarawa Atoll has an inexpensive available work force. The country of Kiribati has a huge underemployment problem at 70 percent [CIA, Kiribati]. It also suffers from an extremely low GDP per capita [CIA, Kiribati].

3.11.3 Disadvantages of Temaiku

- Tarawa Atoll’s annual precipitation is exceeded by Kwajalein’s annual rainfall (Temaiku: 1,900 mm, Kwajalein: 2,600 mm) [Weatherbase].
- The atoll suffers from heavy pollution, open-pit dumping, and limited ground water [CIA, Kiribati].

- Tarawa Atoll is overcrowded. Available space for projects is limited [CIA, Kiribati].
- Kiribati’s citizens suffer from a lower life expectancy and poorer health than citizens of other island nations being considered [CIA, Kiribati].
- Little infrastructure exists for project energy needs or water purification [CIA, Kiribati].
- Although many islanders are available for employment, many of them have few skills.
- The only air service to Temaiku is provided by Air Nauru via the islands of Nauru, Pohnpei, and Guam; and Air Marshall Islands services Tarawa from Majuro [Stanley, p. 836]. The island is isolated.

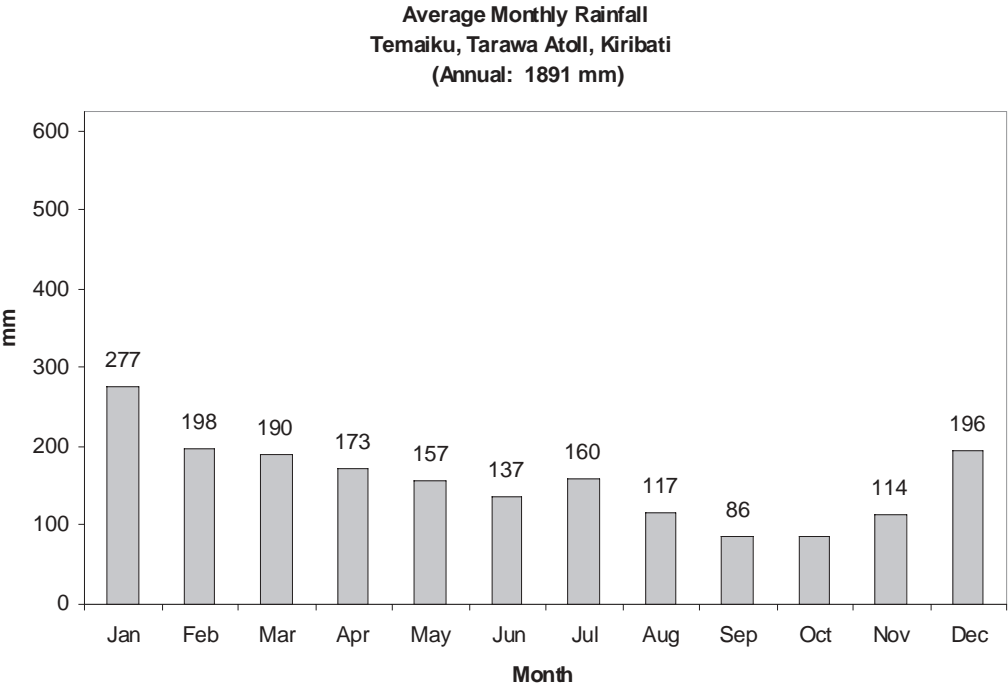


Figure 41. Rainfall for Temaiku, Tarawa Atoll, Kiribati [Weatherbase].

3.12 Tutuila

3.12.1 Overview

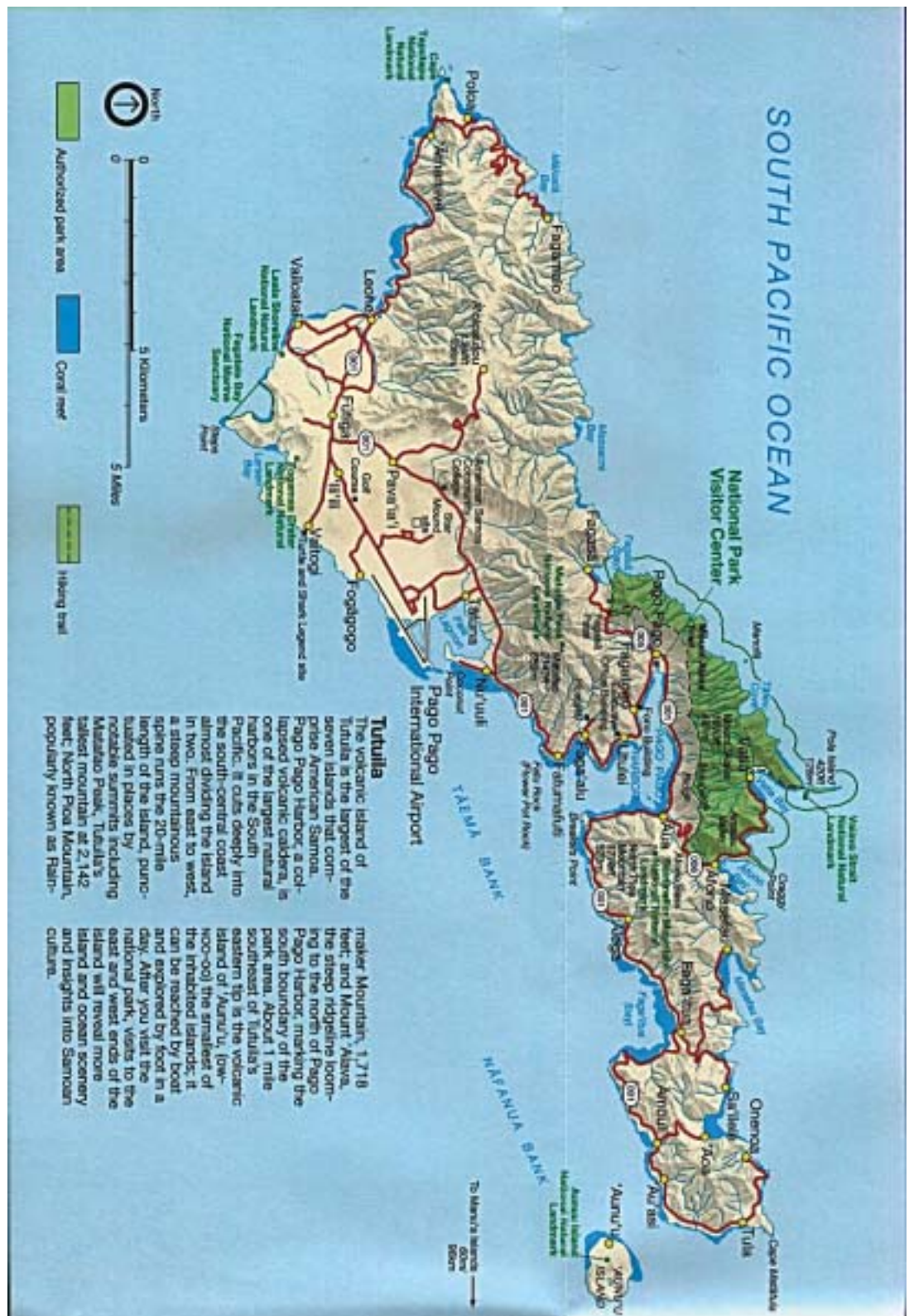
American Samoa encompasses a group of South Pacific islands halfway between Hawai'i and New Zealand. Tutuila's area is 145 sq km [Talbot and Swaney, p. 153]. The island is rugged with elevations exceeding 700 m (see map). The Americans obtained half of the Samoan territory from Germany in an 1899 agreement [CIA, AS]. The people of what was to be called American Samoa have been under American protection ever since [CIA, AS]. The U.S. invested heavily in Tutuila because of Pago Pago, one of the world's finest natural harbors [Stanley, p. 430]. A lengthy mountain chain with peaks between 300 and 700 m forms Tutuila's spine with Pago Pago Harbor bisecting the island's southern coast (see map). The only flat area is the southwestern part of the island, where the airport was constructed jutting into the sea over landfill. One of the Tutuila's greatest advantages is language. Whereas most proposed sites recognize English as an official language, few islanders actually speak it well. Most American Samoans are bilingual, speaking English almost as good as Samoan [CIA, AS]. American Samoa today is a territory of the U.S., sending a non-

voting representative to the American House of Representatives [CIA, AS]. Per capita GDP is among the highest in Oceania [CIA, AS]. Only Palau's is greater [CIA, Palau]. American Samoa has excellent communications. Most recently a company is offering cellular service [CIA, AS]. Tutuila has four stations of rainfall data [NCDC and Weatherbase]. Cape Matatula forms the easternmost point. Pago Pago City lies just to the west of town overlooking the city from a ridge. Pago Pago Airport is located on the south central coast. Vaitogi is situated just to the west of Pago Pago Airport. Pago Pago City's high rainfall reflects the orographic enhancements. Pago Pago Airport and Vaitogi's data are more representative of marine rainfall. Both locations receive on average 3,100 mm per year. However, Cape Matatula, probably the station least influenced by orography, receives only 2,000 mm per year [NOAA]. Cape Matatula's average was computed from only the last 10 years. Eighty percent of the rainfall at Cape Matatula falls during the 8 months between October and May.

Location: 14.4 S 170.0 W



Figure 42. American Samoa (USA) (2000) [University of Texas at Austin Library].



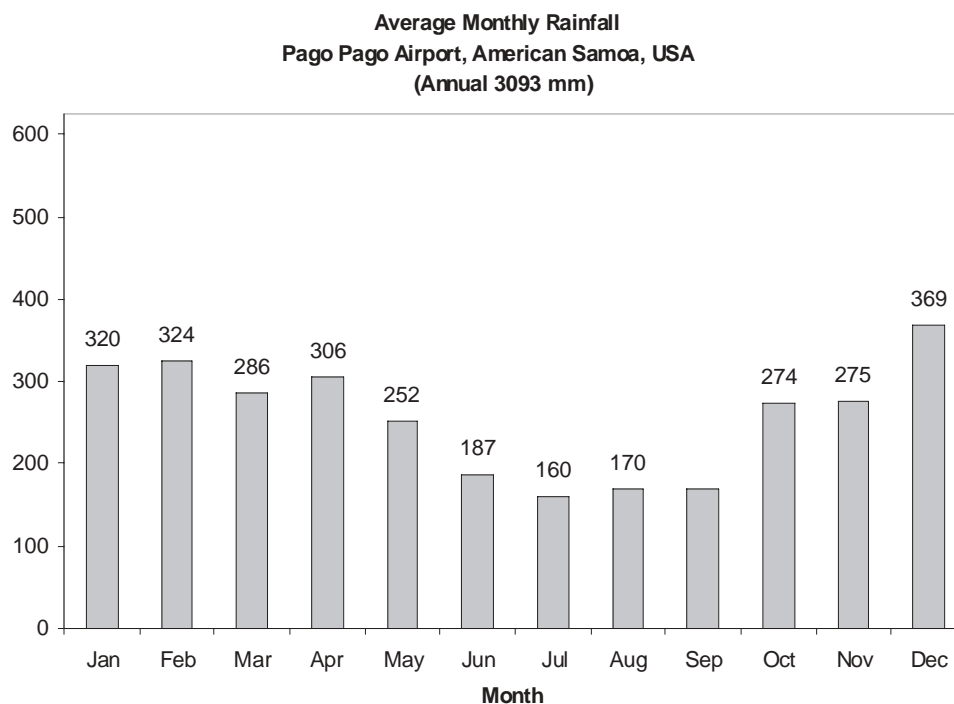


Figure 44. Rainfall for Pago Pago International Airport, American Samoa [NCDC].

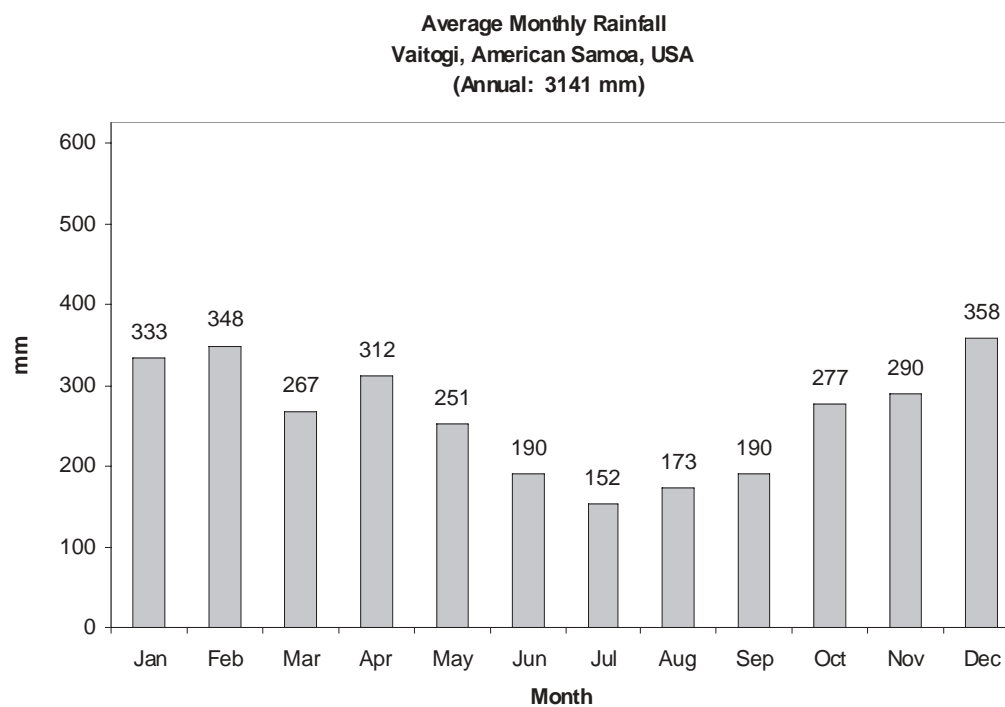


Figure 45. Rainfall for Vaitogi, American Samoa [Weatherbase].

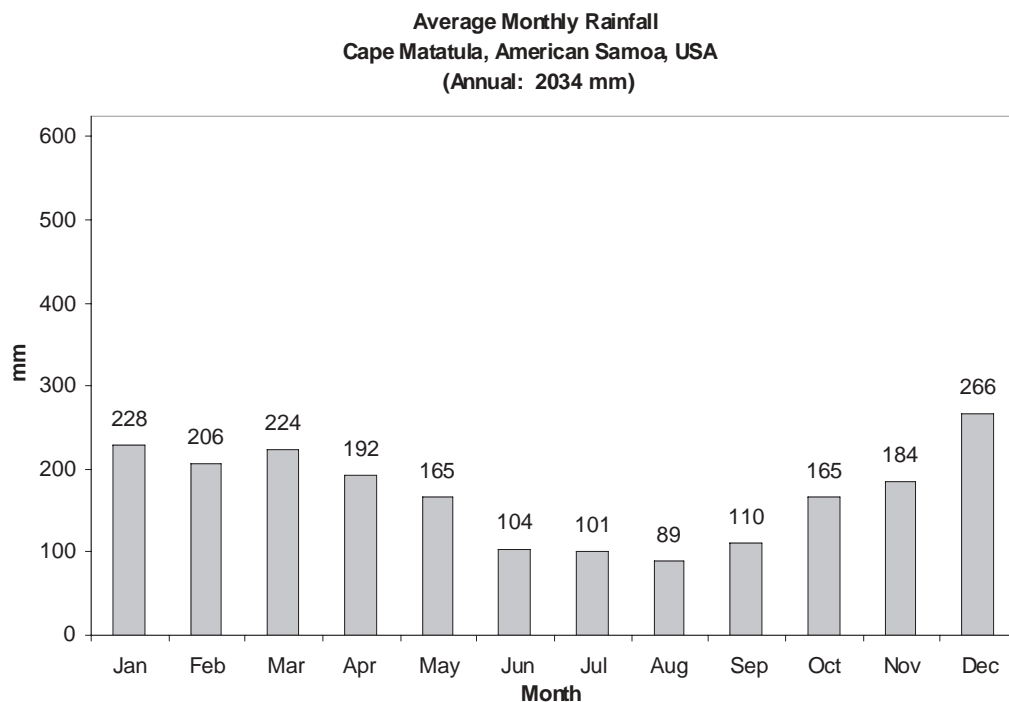


Figure 46. Rainfall for Cape Matatula, American Samoa [NOAA].

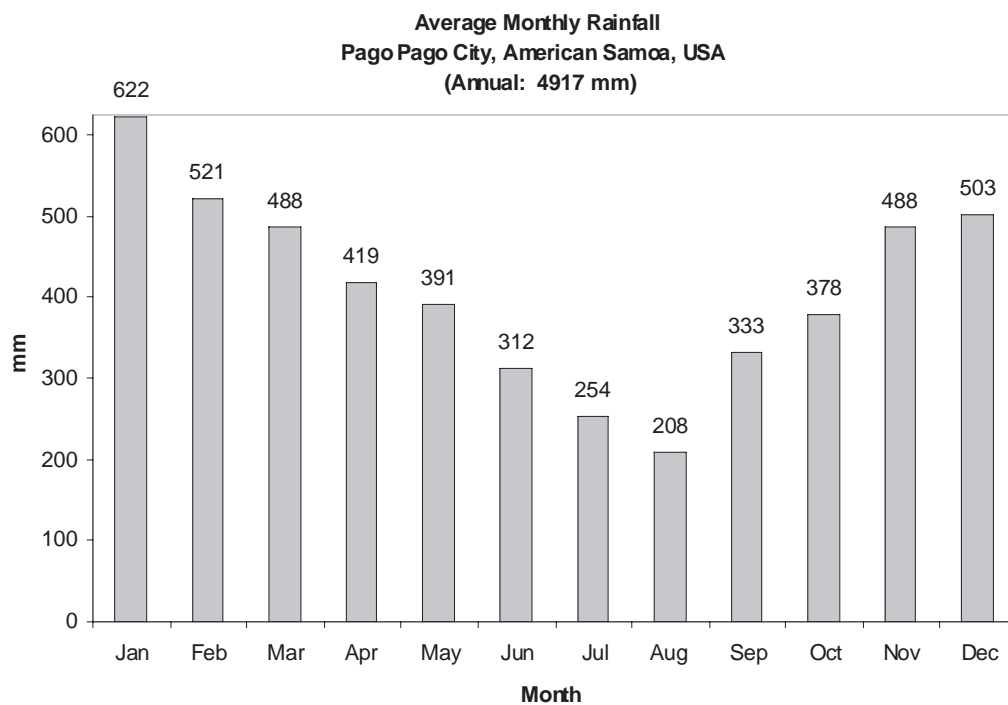


Figure 47. Rainfall for Pago Pago City, American Samoa [NCDC].

3.12.2 Advantages of Tutuila

- On average, Pago Pago City reportedly receives nearly 5,000 mm of rainfall per year (NCDC). However, the airport, farther from Rainmaker Mountain, receives on average closer to 3,100 mm of rain per year [NCDC]. Though probably still affected somewhat by the 300-700 m mountainous spine of the island, Pago Pago Airport's average yearly rainfall is significantly greater than Kwajalein's average yearly rainfall (Kwajalein: 2,600 mm, Pago Pago Airport: 3,100 mm).
- The territorial status of American Samoa ensures close ties to the U.S.
- English is spoken all over the island [CIA, AS].
- The island provides several tourist-oriented amenities including Samoa National Park, north of Pago Pago along the more isolated northern coast.
- The runway at Pago Pago International Airport is very long [CIA, AS].
- The island has low wages without the exorbitantly high unemployment rates of other island countries. The present unemployment rate is 12 percent [CIA, AS].
- The U.S. dollar is the currency [CIA, AS].

- The island enjoys relatively modern infrastructure in communications. Electricity is more dependable than on most Pacific islands. Water is drinkable.
- Transportation is good. Hawaiian Airlines provides service from Honolulu. Most of the island is accessible via automobile with highways running from end to end down its southern shores [Hawaiian Airlines].

3.12.3 Disadvantages of Tutuila

- Although Pago Pago Airport receives greater rainfall amounts than Kwajalein, a NOAA station on the eastern tip of the island at Cape Matatula records only 2,000 mm per year on average during the last decade [NOAA]. Cape Matatula is most likely not as influenced by orographics as much as Pago Pago Airport. Since Cape Matatula's average was calculated from records only within the last 10 years, its value might better reflect the climate of Tutuila at its present state (Kwajalein: 2,600 mm per year, Cape Matatula: 2,000 mm per year).
- Tutuila's mountainous spine will impair any radar coverage to the north. Heights commonly reach between 300 and 700 m.
- Freshwater resources are limited [CIA, AS].

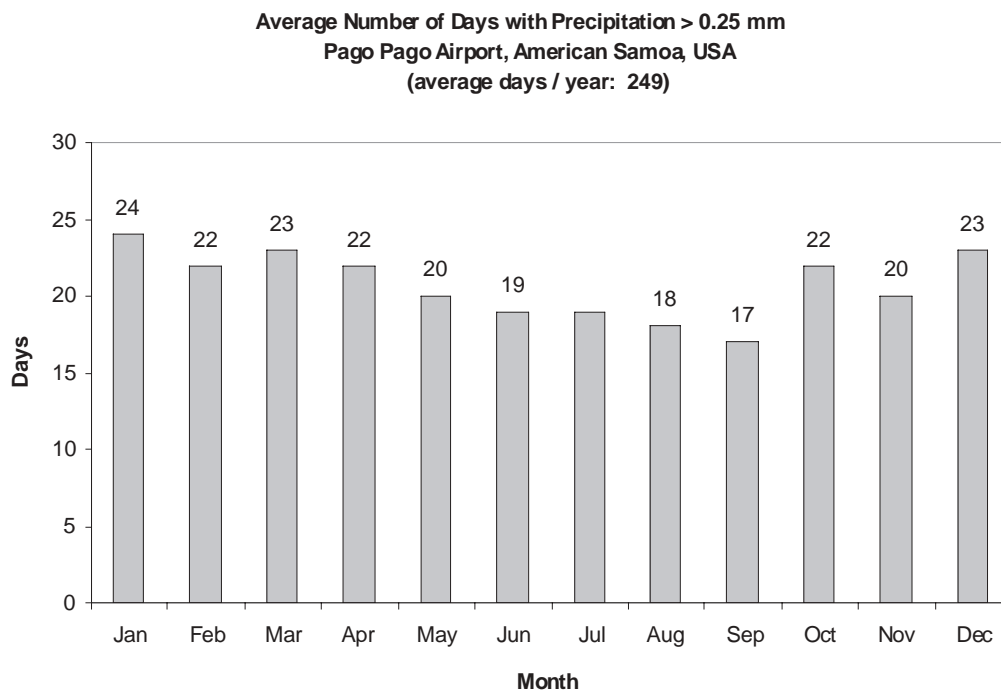


Figure 48. Average frequency of rainfall for Pago Pago Airport, American Samoa [NCDC].

3.13 Weno

3.13.1 Overview

Weno is one of the Chuuk Islands that form part of the Federated States of Micronesia (FSM or simply Micronesia), an island nation in the North Pacific three quarters of the way from Hawai'i to Indonesia. The whole state of Chuuk encompasses 128 sq km. The highest point on Weno reaches 362 m. Weno is the capital island in the FSM state of Chuuk. Chuuk (formerly Truk) and the FSM were previously under American protection [CIA, FSM]. In 1986, the Micronesian states achieved independence by ratifying a Compact of Free Association [CIA, FSM]. Of the four Micronesian states, Chuuk relies most heavily on aid from both the federal government of Micronesia and abroad. Consistent with this fact, Chuuk sends representatives to the capital of Micronesia who consistently support close ties to the U.S. [Ogden]. Other state govern-

ments have criticized Chuuk for wasting aid packages [Bendure and Friary, p. 150]. However, Chuuk's representational advantages in the federal capital have influenced foreign policy, trumping the power of isolationists [Ogden]. Chuuk by far is the most populous state within the FSM at 49,000, but it is also the poorest with a per capita GNP of \$1,050, half that of more prosperous Yap [FSM Government]. State government corruption often results in fuel shortages and funding shortfalls for education [Bendure and Friary, p. 150]. The only infrastructure of any sophistication is on Weno [Bendure and Friary, p. 153]. Chuuk receives heavy rainfall (3,500 mm on average) throughout the year with only slight seasonality [NCDC]. Fifty-eight percent of precipitation falls between May and October.

Location: 7.4 N 151.7 E



Figure 49. The main islands of Chuuk (1970). Weno (referred to as Moen on this map) is in the northeastern part of the lagoon [University of Texas at Austin Library].

3.13.2 Advantages of Weno

- Weno receives 3,500 mm per year on average. This is significantly greater than Kwajalein's yearly average (2,600 mm). Weno's wet season months are only slightly wetter than Kwajalein's; however, the wet season lasts longer than it does on Kwajalein [NCDC].
- Wages are kept low because Chuuk suffers from both high unemployment and the lowest GDP per capita of the four Micronesian states [FSM Government].
- The island is accessible via Continental Air Micronesia, which maintains flight service through Guam to Honolulu [Continental Airlines].
- Dependence on foreign aid has encouraged the state to support warm ties with the U.S. [Ogden].

- The U.S. dollar is the official currency [CIA, FSM].
- English is one of the official languages [CIA, FSM].

3.13.3 Disadvantages of Weno

- Weno is located within a group of volcanic islands. The peaks on Weno extend up to 300 m, potentially limiting radar coverage.
- Although many potential laborers are available for project support, few possess any skills.
- Weno's existing weak infrastructure suffers from neglect by a corrupt state government. Roads need widespread repairs. Infrastructure for energy is more primitive than on other Micronesian islands. The water on Chuuk needs boiling [Bendure and Friary, p. 159].

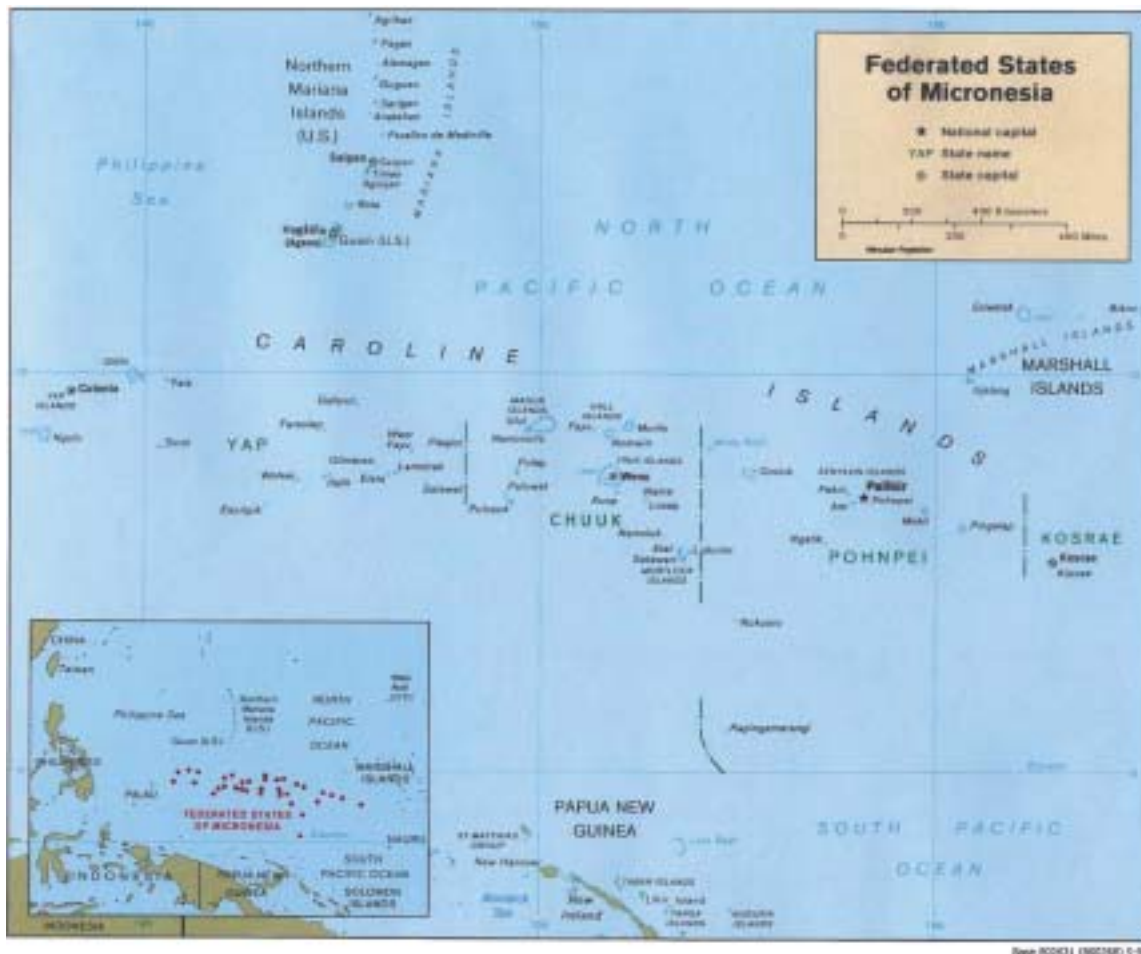


Figure 50. The FSM (1989). Chuuk lies in the central part of the island nation. Its capital is Weno [University of Texas at Austin Library].

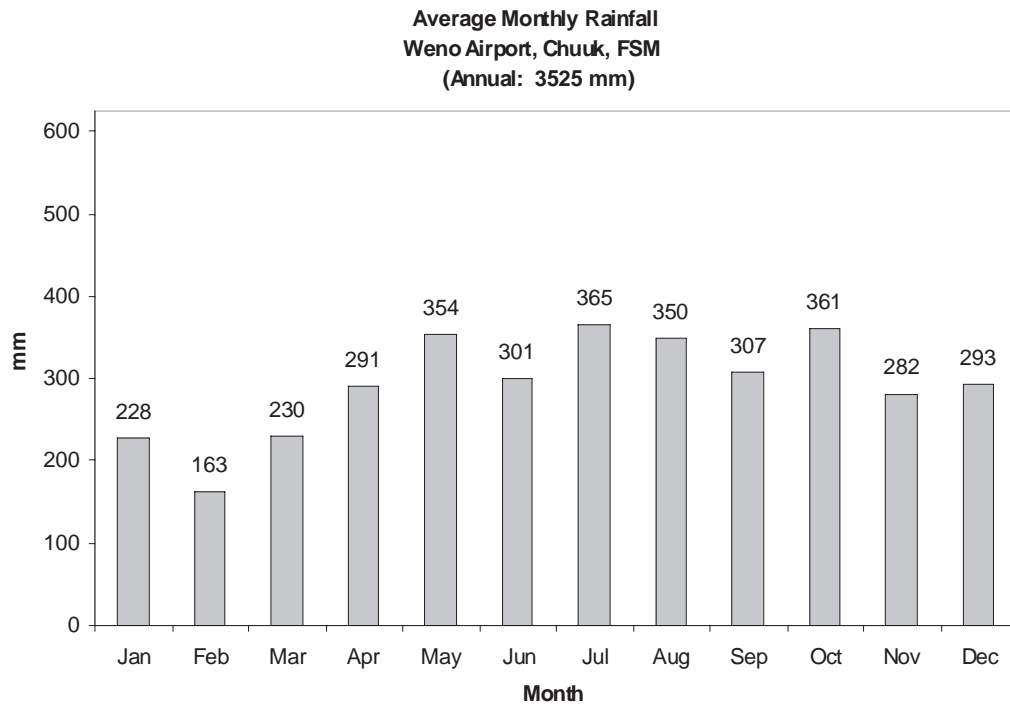


Figure 51. Rainfall at Weno, Chuuk, FSM [NCDC].

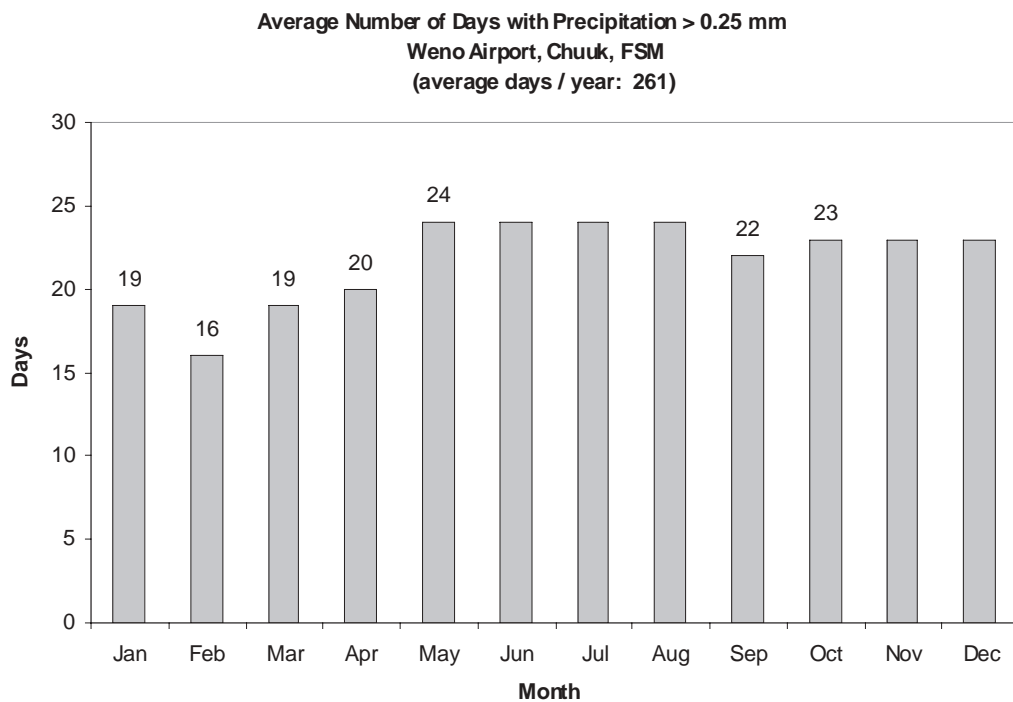


Figure 52. Average frequency of rainfall for Weno Airport, Chuuk, FSM [NCDC].

3.14 Yap

3.14.1 Overview

Yap is one island in the Federated States of Micronesia (FSM or simply Micronesia), an island nation in the North Pacific three quarters of the way from Hawai'i to Indonesia. The Yap Islands cover 105 sq km [Bendure and Friary, p. 172]. Yap and the FSM were formerly under American protection [CIA, FSM]. In 1986, the Micronesian states ratified a compact of Free Association with Washington; thereby gaining independence in exchange for the right of land confiscation by the American military if needed [CIA, FSM]. Yap is one of four Micronesian states. Yap is an older, eroded volcanic island. Its highest point is 175 m [Bendure and Friary, p. 172]. Channels of seawater pass through low points in the original land mass and thus Yap consists of four islands. The islands of Yap, Map, and Tomil lie close enough for bridges to link them [Bendure and Friary, p. 177]. Of all four Micronesian states, Yap is culturally the most traditional [Bendure and Friary, p. 170]. The islanders still use a system of giant stone money [Bendure and Friary, p. 170]. Governmental watchdogs have praised Yap's wise investments in regards to choice of infrastructure

improvements, education spending, and social programs [Levy, p. 133]. Today, the state's per capita GNP ranks as the highest in the FSM, nearly matching that of American Samoa [FSM Government]. Much of Yap's prosperity is due to economic restraint. For example, some Micronesian states leave incomplete overly ambitious island-wide road projects that drain their local economies. Yap constructed a far more modest road spanning three islands and keeps it in good repair [Bendure and Friary, p. 190]. The Japanese used Yap as a communications hub both before and during World War II and hence built an airfield that today lies abandoned, very close to the new airport [Bendure and Friary, pp. 182-183]. Today, the U.S. Coast Guard maintains a lighthouse overlooking Colonia Harbor [Levy, p. 140]. Since Yap lies at a more southerly latitude than Kwajalein, the island receives heavier rainfall from the ITCZ. NCDC records show its annual average to exceed 3,000 mm compared to Kwajalein's 2,600 mm. Like Kwajalein, Yap's rainfall is also heavily seasonal. Fifty-six percent of its rainfall falls in the five months from June through October, and 79 percent of its rain falls between May and December.

Location: 9.6 N 138 E



Figure 53. Yap, Map, and Tomil Islands (1970). All three islands are connected by bridges. The airport and the weather station lie in the southwest [University of Texas at Austin Library].

3.14.2 Advantages

- Yap on average receives 3,000 mm of rainfall per year (Kwajalein receives 2,600 mm yearly). A wet season stretches from May to December [NCDC].
- The FSM experiences nationwide high unemployment; therefore, wages are low. At the same time GDP per capita is highest on Yap than in any of the other Micronesian states [FSM Government].
- Yap's mid-level topography (reaching to an elevation of 174 m at Tabiwol) reduces natural barriers to most radar tilts, unlike the tall volcanic centers of some island sites.
- Transportation to Yap is provided by Continental Micronesia from Honolulu via Guam [Continental Airlines].

- Bridges connect three islands.
- English is one official language [CIA, FSM].
- All of the FSM uses the American dollar as currency [CIA, FSM].

3.14.3 Disadvantages

- The labor force holds few skills and is largely uneducated.
- Energy infrastructure such as electricity is not as reliable as on other more developed islands. Communication is unreliable. Water supplies are undrinkable [Bendure and Friary, p. 188].

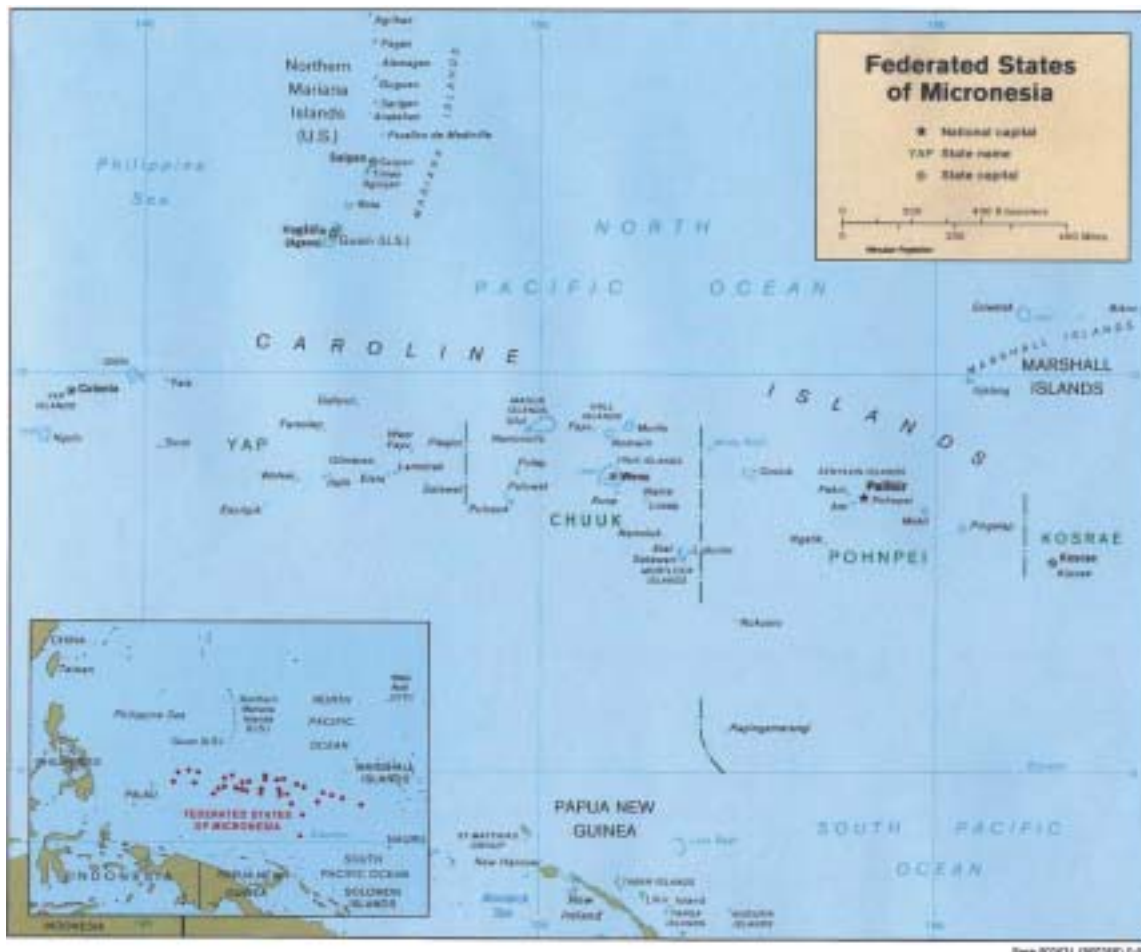


Figure 54.
The FSM (1989). Yap Island is located in the far western reaches of the island nation [University of Texas at Austin Library].

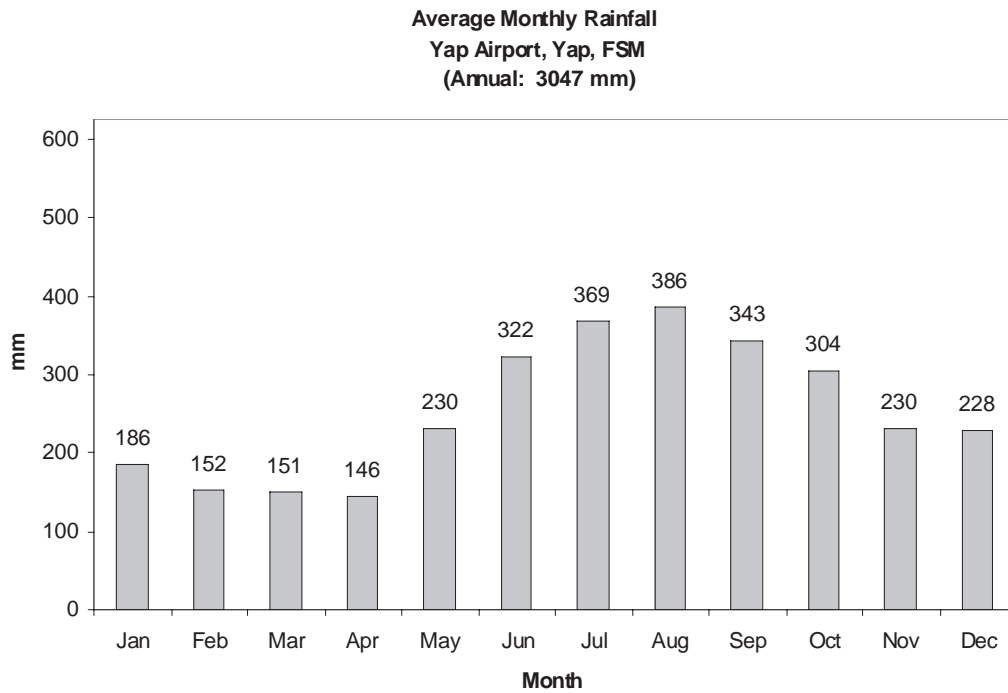


Figure 55. Rainfall at Yap, FSM [NCDC].

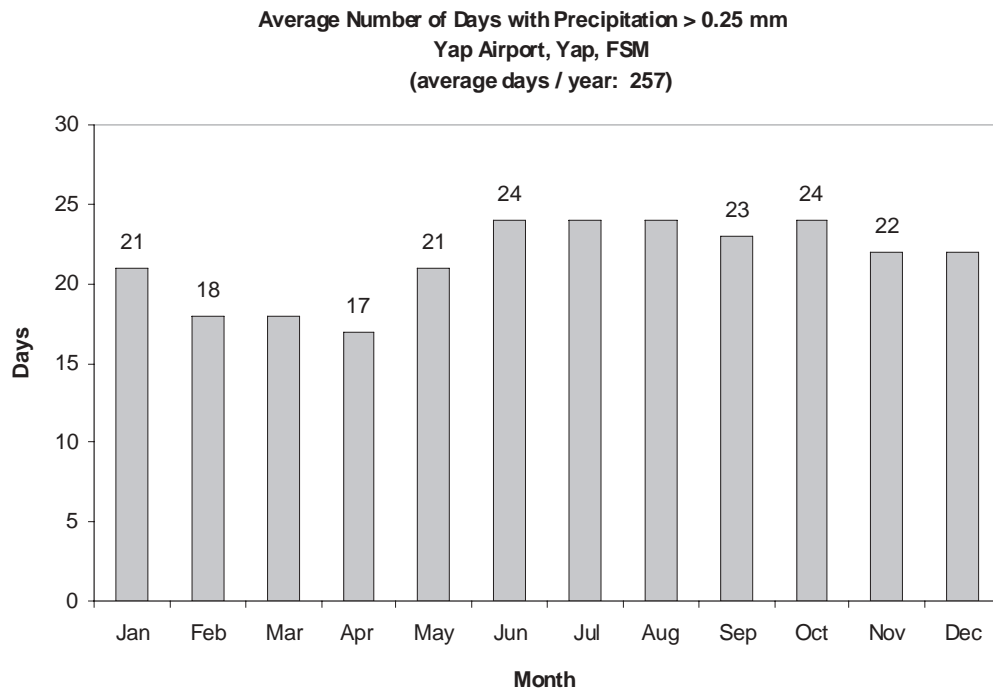


Figure 56. Average frequency of rainfall for Yap Airport, Yap, FSM [NCDC].

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5.0 Appendix 1

Island	Country	Background (CIA)	Latitude	Longitude
Atafu	Tokelau	Originally settled by Polynesian emigrants from surrounding island groups, the Tokelau Islands were made a British protectorate in 1889. They were transferred to NZ administration in 1925.	9 00 S	172 00 W
Diego Garcia	British Indian Ocean Territory	The British Indian Ocean Territory--no permanent civilian population remains--formed Nov 1965 (CIA). The native Chagosians were removed from the island between 1967 and 1973. With a favorable London High Court ruling, the Chagosians might return before	6 00 S	71 30 E
Fongafale	Tuvalu	In 1974, ethnic differences within the British colony of the Gilbert and Ellice Islands caused the Polynesians of the Ellice Islands to vote for separation from the Micronesians of the Gilbert Islands. The following year, the Ellice Islands became the se	8 00 S	178 00 E
Gan	Maldives	The Maldives were long a sultanate, first under Dutch and then under British protection. They became a republic in 1968, three years after independence. Tourism and fishing are being developed on the archipelago.	3 15 N	73 00 E
Key West	United States	Key West was founded in 1822 as a naval depot to rid the Gulf of Mexico and Caribbean of pirates. The town then refocused its economy to fishing and salvaging shipwrecks. By 1890 it had become the richest city in Florida. Many great artists found inspi	24 36 N	81 42 W
Kiritimati	Kiribati	Formerly Christmas Island (part of Line Island Chain). The Gilbert Islands were granted self-rule by the UK in 1971 and complete independence in 1979 under the new name of Kiribati. The US relinquished all claims to the sparsely inhabited Phoenix and Li	2 00 N	157 00 W
Koror	Palau	After three decades as part of the UN Trust Territory of the Pacific under US administration, this westernmost cluster of the Caroline Islands opted for independent status in 1978 rather than join the Federated States of Micronesia. A Compact of Free Ass	7 30 N	134 30 E
Sources: CIA Factbook, BBC, various airlines, FSM Government				

Island	Country	Background (CIA)	Latitude	Longitude
Kosrae	Micronesia	In 1979 the Federated States of Micronesia, a UN Trust Territory under US administration, adopted a constitution. In 1986 independence was attained under a Compact of Free Association with the United States. Present concerns include large-scale unemployment, overfishing, and overdependence on US aid.	5 10 N	162 35 E
Kwajalein	Marshall Islands	After almost four decades under US Administration as the easternmost part of the UN Trust Territory of the Pacific Islands, the Marshall Islands attained independence in 1986 under a Compact of Free Association. Compensation claims continue as a result of US nuclear testing on some of the islands between 1947 and 1962.	8 30 N	167 15 E
Pohnpei	Micronesia	In 1979 the Federated States of Micronesia, a UN Trust Territory under US administration, adopted a constitution. In 1986 independence was attained under a Compact of Free Association with the United States. Present concerns include large-scale unemployment, overfishing, and overdependence on US aid.	6 55 N	158 15 E
Temaiku	Kiribati	The Gilbert Islands were granted self-rule by the UK in 1971 and complete independence in 1979 under the new name of Kiribati. The US relinquished all claims to the sparsely inhabited Phoenix and Line Island groups in a 1979 treaty of friendship with Kiribati.	1 25 N	173 00 E
Tutuila	American Samoa	Settled as early as 1000 BCE, Samoa was "discovered" by European explorers in the 18th century. International rivalries in the latter half of the 19th century were settled by an 1899 treaty in which Germany and the US divided the Samoan archipelago. The US formally occupied its portion - a smaller group of eastern islands with the excellent harbor of Pago Pago - the following year.	14 20 S	170 00 W
Weno	Micronesia	In 1979 the Federated States of Micronesia, a UN Trust Territory under US administration, adopted a constitution. In 1986 independence was attained under a Compact of Free Association with the United States. Present concerns include large-scale unemployment, overfishing, and overdependence on US aid.	7 20 N	151 45 E
Yap	Micronesia	In 1979 the Federated States of Micronesia, a UN Trust Territory under US administration, adopted a constitution. In 1986 independence was attained under a Compact of Free Association with the United States. Present concerns include large-scale unemployment, overfishing, and overdependence on US aid.	9 35 N	138 10 E
Sources: CIA Factbook, BBC, various airlines, FSM Government				

Island	Area	Terrain Description	Highest Point	Natural Hazards	Environmental - Current Issues (CIA)
Atafu	3 sq km	low-lying coral atoll enclosing large lagoon	5 m	typhoons	Very limited natural resources and overcrowding
Diego Garcia	60 sq km	low-lying coral atoll enclosing large lagoon.	15 m	sea-level rise	
Fongafale	26 sq km	low-lying coral atoll enclosing large lagoon.	5 m	occasional typhoons	Groundwater is not potable, water needs must be met by catchment systems with storage facilities (the Japanese Government has built one desalination plant and plans to build one other); beachhead erosion because of the use of sand for building materials; excessive clearance of forest undergrowth for use as fuel; damage to coral reefs from the spread of the Crown of Thorns starfish; sea-level rise resulting from global greenhouse emissions.
Gan	12 sq km (atoll)	low-lying coral atoll enclosing large lagoon.	2 m	sea-level rise	Depletion of freshwater aquifers threatens water supplies; global warming and sea level rise; coral reef bleaching
Key West	7 sq km	southwestern most island in a chain of low islands called keys off the tip of the Florida peninsula.	4 m	hurricanes; sea-level rise	Sensitive to sea level rise
Kiritimati	420 sq km	low-lying coral atoll enclosing large lagoon.	~20 m	typhoon season: Nov-Mar; occasional tornadoes; sea-level rise	Climate becoming drier in recent years and putting water table at risk. Even though testing has not yielded abnormal levels of radiation, questions remain after years of nuclear testing.
Koror	10 sq km	Koror itself is a limestone outcropping of neighboring Babelthuap Island, which is a high mountainous volcanic island of 153 sq km.	242 m (Mt. Ngerchelchauus on Babelthuap	typhoon season: Jun-Dec	inadequate facilities for disposal of solid waste; threats to the marine ecosystem from sand and coral dredging, illegal fishing practices, and overfishing
Sources: CIA Factbook, BBC, various airlines, FSM Government					

Island	Area	Terrain Description	Highest Point	Natural Hazards	Environmental - Current Issues (CIA)
Kosrae	109 sq km	high mountainous island of volcanic origins	629 m (Mt Finkel)	typhoon season: Jun-Dec	
Kwajalein	14 sq km	low-lying coral atoll enclosing large lagoon.	~5 m	Occasional typhoons	inadequate supplies of potable water
Pohnpei	334 sq km	high mountainous island of volcanic origins	774 m on Nahnalaud	typhoon season: Jun-Dec	
Temaiku	26 sq km	low-lying coral atoll enclosing large lagoon.	~5 m	typhoon season: Nov-Mar; occasional tornadoes; sea-level rise	heavy pollution in lagoon of south Tarawa atoll due to heavy migration mixed with traditional practices such as lagoon latrines and open-pit dumping; ground water at risk.
Tutuila	145 sq km	volcanic island with rugged peaks and limited coastal plains	966 m Lata	typhoon season: Dec to Mar	limited natural fresh water resources; the water division of the government has spent substantial funds in the past few years to improve water catchments and pipelines.
Weno	128 sq km	high mountainous island of volcanic origins	362 m	typhoon season: Jun-Dec	Most polluted island in the FSM.
Yap	105 sq km	low mountainous island of volcanic origins	174 m (Mt. Tabiwol)	typhoon season: Jun-Dec	
Sources: CIA Factbook, BBC, various airlines, FSM Government					

Island	Population	Life Expectancy	Languages	Literacy	Country Name	Dependency Status	Government Type
Atafu	500	no data	Tokelauan, English	94%	Tokelau	territory of New Zealand; note - moving toward free association with NZ.	drafting constitution and setting up government institutions
Diego Garcia	3,200	78	English	99%	British Indian Ocean Territory	overseas territory of the UK; administered by a commissioner, resident in the Foreign and Commonwealth Office in London	territory
Fongafale	4,000	66	Tuvaluan, English	unk	Tuvalu		constitutional monarchy with a parliamentary democracy; began debating republic status in 1992
Gan	17,000 (atoll), 1,200 (island)	69	Maldivian Dhivehi, English spoken by most	93%	Republic of Maldives		republic
Key West	26,000	77	English, Spanish	97%	United States of America		federal republic; strong democratic tradition
Kiritimati	3,200	63	English (official), Gilbertese	90%	Republic of Kiribati		republic
Koror	11,000	69	English and Palauan official	92%	Republic of Palau		Constitutional government in free association with the US
Sources: CIA Factbook, BBC, various airlines, FSM Government							

Island	Population	Life Expectancy	Languages	Literacy	Country Name	Dependency Status	Government Type
Kosrae	8,100	69	English (official), Kosraean	89%	Federated States of Micronesia		constitutional government in free association with the US
Kwajalein	3,000	66	English (universally spoken)	93%	Republic of the Marshall Islands		constitutional government in free association with the US
Pohnpei	32,000	69	English (official), Pohnpeian	89%	Federated States of Micronesia		constitutional government in free association with the US
Temaiku	33,000	63	English (official), Gilbertese	90%	Republic of Kiribati		republic
Tutuila	65,000	75	Samoan, English (note: most people are bilingual)	97%	Territory of American Samoa	unincorporated and unorganized territory of the US; administered by the Office of Insular Affairs, US Department of the Interior	Has a popularly elected governor, a bi-cameral legislature and an elected non-voting delegate to the US H of R
Weno	18,000	69	English (official), Trukese	89%	Federated States of Micronesia		constitutional government in free association with the US
Yap	11,500	69	English (official), Yapese	89%	Federated States of Micronesia		constitutional government in free association with the US
Sources: CIA Factbook, BBC, various airlines, FSM Government							

Island	Capital	Colonial Power	Legal System	Diplomatic Representation in US
Atafu		UK, NZ	British and local statutes	
Diego Garcia	NA	UK	British	Ambassador Sir Christopher J. R. MEYER; 3100 Massachusetts Avenue NW; Washington, DC 20008; (202)588-6500; consulates in several cities
Fongafale	Fongafale on Funafuti Atoll	UK		no embassy
Gan	Male	UK	based on Islamic law with admixtures of English common law primarily in commercial matters	a permanent mission to the UN in New York
Key West	Washington, DC (state capital Tallahassee)	Spain		
Kiritimati	Temaiku on Tarawa Atoll	UK		honorary consulate in Honolulu
Koror	Koror - a new capital is being built about 20 km northeast of Koror	USA	based on Trust Territory laws, acts of the legislature, municipal, common, and customary laws	Ambassador Hersey KYOTA; 1150 18th Street NW, Suite 750, Washington, DC 20036; (202)452-6814
Sources: CIA Factbook, BBC, various airlines, FSM Government				

Island	Capital	Colonial Power	Legal System	Diplomatic Representation in the US
Kosrae	Palikir (state capital Lelu)	USA	based on adapted Trust Territory laws, acts of the legislature, municipal, common, and customary laws	Ambassador Jesse Bibiano MAREHALAU; 1725 N Street NW; Washington, DC 20036; telephone (202)223-4383; consulates general: Honolulu, Tamuning (Guam)
Kwajalein	Majuro	USA	based on adapted Trust Territory laws, acts of the legislature, municipal, common, and customary laws	Ambassador Banny DE BRUM; 2433 Massachusetts Ave NW; Washington, DC 20008; (202)234-5414 consulate general: Honolulu
Pohnpei	Palikir on Pohnpei (state capital Kolonia)	USA	based on adapted Trust Territory laws, acts of the legislature, municipal, common, and customary laws	Ambassador Jesse Bibiano MAREHALAU; 1725 N Street NW; Washington, DC 20036; telephone (202)223-4383; consulates general: Honolulu, Tamuning (Guam)
Temaiku	Temaiku on Tarawa Atoll	UK		honorary consulate in Honolulu
Tutuila	Pago Pago	USA		
Weno	Palikir (state capital Weno)	USA	based on adapted Trust Territory laws, acts of the legislature, municipal, common, and customary laws	Ambassador Jesse Bibiano MAREHALAU; 1725 N Street NW; Washington, DC 20036; telephone (202)223-4383; consulates general: Honolulu, Tamuning (Guam)
Yap	Palikir (state capital Kolonia)	USA	based on adapted Trust Territory laws, acts of the legislature, municipal, common, and customary laws	Ambassador Jesse Bibiano MAREHALAU; 1725 N Street NW; Washington, DC 20036; telephone (202)223-4383; consulates general: Honolulu, Tamuning (Guam)
Sources: CIA Factbook, BBC, various airlines, FSM Government				

Island	Economy Overview
Atafu	Tokelau's small size (three villages), isolation, and lack of resources greatly restrain economic development and confine agriculture to the subsistence level. The people must rely on aid from NZ to maintain public services, annual aid being substantially greater than GDP. The principal sources of revenue come from sales of copra, postage stamps, souvenir coins, and handicrafts. Money is also remitted to families from relatives in NZ.
Diego Garcia	All economic activity is concentrated on the largest island of Diego Garcia, where joint UK- US defense facilities are located. Construction projects and various services needed to support the defense installations are done by military and contract employees from the UK, Mauritius, the Philippines, and the US. There are no industrial or agricultural activities on the islands.
Fongafale	Subsistence farming and fishing are the primary economic activities. Government revenues largely come from the sale of stamps and coins and worker remittances. Nauru has begun repatriating Tuvaluans who worked in its phosphate mines as phosphate resources decline. Thanks to wise investments and conservative withdrawals, an international trust fund has grown from an initial \$17 million to over \$35 million in 1999. Tuvalu collects payment from the US for the use of its fisheries. In an effort to reduce its dependence on foreign aid, the government is pursuing privatization of some government functions and personnel cuts of up to 7%. In 1998, Tuvalu began deriving revenue from use of its area code for "900" lines and from the sale of its ".tv" Internet domain name.
Gan	Tourism, Maldives' largest industry, accounts for 20% of GDP and more than 60% of Maldives' foreign exchange receipts. Over 90% of government tax revenue comes from import duties and tourism-related taxes. Almost 400,000 tourists visited the islands in 1998. Fishing is a second leading sector. The Maldivian Government began an economic reform program in 1989 initially by lifting import quotas and opening some exports to the private sector. Subsequently, it has liberalized regulations to allow more foreign investment. Agriculture and manufacturing continue to play a minor role in the economy, constrained by the limited availability of cultivable land and the shortage of domestic labor. Most staple foods must be imported. Industry, which consists mainly of garment production, boat building, and handicrafts, accounts for about 18% of GDP.
Key West	Today the economy relies mainly on tourism although government supplies many jobs through Key West Naval Air Station.
Kiritimati	Kiritimati has few national resources. Copra and fish now represent the bulk of production and exports. The economy has fluctuated widely in recent years. Economic development is constrained by a shortage of skilled workers, weak infrastructure, and remoteness from international markets. Tourism provides more than one-fifth of GDP. The financial sector is at an early stage of development as is the expansion of private sector initiatives. Foreign financial aid, largely from the UK and Japan, is a critical supplement to GDP, equal to 25%-50% of GDP in recent years. Remittances from workers abroad account for more than \$5 million each year.
Koror	The economy consists primarily of subsistence agriculture and fishing. The government is the major employer of the work force, relying heavily on financial assistance from the US. The population enjoys a per capita income of more than twice that of the Philippines and much of Micronesia. Long-run prospects for the tourist sector have been greatly bolstered by the expansion of air travel in the Pacific and the rising prosperity of leading East Asian countries.
	Sources: <i>CIA Factbook, BBC, various airlines, FSM Government</i>

Island	Economy Overview (CIA)
Kosrae	Economic activity consists primarily of subsistence farming and fishing. The islands have few mineral deposits worth exploiting, except for high-grade phosphate. The potential for a tourist industry exists but the remoteness of the location and a lack of adequate facilities hinder development. Financial assistance from the US is the primary source of revenue, with the US pledged to spend \$1.3 billion in the islands in 1986-2001. Geographical isolation and a poorly developed infrastructure are major impediments to long-term growth.
Kwajalein	US Government assistance is the mainstay of this tiny island economy. Agricultural production is concentrated on small farms, and the most important commercial crops are coconuts, tomatoes, melons, and breadfruit. Small-scale industry is limited to handicrafts, fish processing, and copra. The tourist industry, now a small source of foreign exchange employing less than 10% of the labor force, remains the best hope for future added income. The islands have few natural resources, and imports far exceed exports. Under the terms of the Compact of Free Association, the US provides roughly \$65 million in annual aid. Negotiations were underway in 1999 for an extended agreement. Government downsizing, drought, a drop in construction, and the decline in tourism and foreign investment due to the Asian financial difficulties caused GDP to fall in 1996-1998.
Pohnpei	Economic activity consists primarily of subsistence farming and fishing. The islands have few mineral deposits worth exploiting, except for high-grade phosphate. The potential for a tourist industry exists but the remoteness of the location and a lack of adequate facilities hinder development. Financial assistance from the US is the primary source of revenue, with the US pledged to spend \$1.3 billion in the islands in 1986-2001. Geographical isolation and a poorly developed infrastructure are major impediments to long-term growth.
Temauku	Tarawa has few national resources. Commercially viable phosphate deposits were exhausted at the time of independence from the UK in 1979. Copra and fish now represent the bulk of production and exports. The economy has fluctuated widely in recent years. Economic development is constrained by a shortage of skilled workers, weak infrastructure, and remoteness from international markets. Tourism provides more than one-fifth of GDP. The financial sector is at an early stage of development as is the expansion of private sector initiatives. Foreign financial aid, largely from the UK and Japan, is a critical supplement to GDP, equal to 25%-50% of GDP in recent years. Remittances from workers abroad account for more than \$5 million each year.
Tutuila	This is a traditional Polynesian economy in which more than 90% of the land is communally owned. Economic activity is strongly linked to the US, with which American Samoa conducts the great bulk of its foreign trade. Tuna fishing and tuna processing plants are the backbone of the private sector, with canned tuna the primary export. Transfers from the US Government add substantially to American Samoa's economic well-being. Attempts by the government to develop a larger and broader economy are restrained by Samoa's remote location, its limited transportation, and its devastating hurricanes. Tourism, a developing sector, may be held back by the current financial difficulties in East Asia.
Weno	Economic activity consists primarily of subsistence farming and fishing. The islands have few mineral deposits worth exploiting, except for high-grade phosphate. The potential for a tourist industry exists but the remoteness of the location and a lack of adequate facilities hinder development. Financial assistance from the US is the primary source of revenue, with the US pledged to spend \$1.3 billion in the islands in 1986-2001. Geographical isolation and a poorly developed infrastructure are major impediments to long-term growth.
Yap	Economic activity consists primarily of subsistence farming and fishing. The islands have few mineral deposits worth exploiting, except for high-grade phosphate. The potential for a tourist industry exists but the remoteness of the location and a lack of adequate facilities hinder development. Financial assistance from the US is the primary source of revenue, with the US pledged to spend \$1.3 billion in the islands in 1986-2001. Geographical isolation and a poorly developed infrastructure are major impediments to long-term growth.
Sources: CIA Factbook, BBC, various airlines, FSM Government	

Island	GDP-per capita	Inflation Rate	Inflation	Electricity - production	Currency	Exchange Rates	Cell Phones
Atafu	\$1,000				NZ\$	1.94 NZ\$ = 1 US\$	0
Diego Garcia	\$21,800	2%	6%	supplied by US Military	US\$ and British Pound		
Fongafale	\$800	4%		3 million kWh	T\$ (Tuvaluan dollar) or A\$ (Australian dollar)	1.52 T\$ = 1.52 A\$ = 1 US\$	0
Gan	\$1,840	3%		85 million kWh	rifiyaa (Rf)	11.77 Rf = 1 US\$	10,000
Key West	\$33,900	2%	4%	3.62 trillion kWh	US\$		69.2 million (country)
Kiritimati	\$860	2%	2% unemployment, 70% underemployment	7 million kWh	Australian\$	1.52 A\$ = 1 US\$	0
Koror	\$8,800		7%	200 million kWh	US\$		0
Sources: CIA Factbook, BBC, various airlines, FSM Government							

Island	GDP - per capita	Inflation Rate	Unemployment Rate	Electricity - production	Currency	Exchange Rates	Cell Phones
Kosrae	\$1,500 (FSM Government)	4%	27%		US\$		0
Kwajalein	\$1,670	5%	16%	57 million kWh (on Kwajalein supplied by US military)	US\$		365
Pohnpei	\$1,500 (FSM Government)	4%	27%		US\$		0
Temaiku	\$860	2%	2% unemployment, 70% underemployment	7 million kWh	Australian\$	1.52 A\$ = 1 US\$	0
Tutuila	\$2,600		12%	125 million kWh	US\$		2550
Weno	\$1,050 (FSM Government)	4%	27%		US\$		0
Yap	\$2,110 (FSM Government)	4%	27%		US\$		0
Sources: CIA Factbook, BBC, various airlines, FSM Government							

Island	Telephone System	Radio Stations	TV Stations	ISPs
Atafu	domestic: radiotelephone service between islands. Intl: radiotelephone service to Samoa; government-regulated telephone service (TeleTok), with 3 satellite earth stations, established in 1997	NA, each atoll has shipping and weather radio stations	0	NA
Diego Garcia	separate facilities for military and public needs are available. Domestic: all commercial telephone services are available, including connection to the Internet. Intl: International telephone service is carried by satellite (2000)	AM 1 FM 2 shortwave 0	1	military
Fongafale	domestic: radiotelephone communications between islands. Intl: NA	AM 1 FM 0 shortwave 0	0	1
Gan	domestic: interatoll communication through microwave links; all inhabited islands are connected with telephone and fax service / intl: satellite earth station - 3 Intelsat (Indian Ocean)	AM 1 FM 1 shortwave 1	1	1
Key West	domestic: a large system of fiber-optic cable, microwave radio relay, coaxial cable, and domestic satellites carries every form of telephone traffic; a rapidly growing cellular system carries mobile telephone traffic throughout the country. Intl: 24 ocean cable systems in use; satellite earth stations - 61 Intelsat (45 Atlantic and 16 Pacific), 5 Intersputnik (Atlantic), and 4 Inmarsat (Pacific and Atlantic)	at least 1 AM and 8 FM.	8 local plus many on cable	many
Kiritimati	domestic: NA; intl: satellite earth station - Intelsat (Pacific Ocean). Note: Kiribati is being linked to the Pacific Ocean Cooperative Telecommunications Network, which should improve telephone service	AM 1 FM 1 shortwave 1	1	1
Koror	domestic: NA; intl: satellite earth station - Intelsat (Pacific Ocean)	AM 1 FM 0; shortwave 1	1	1
	Sources: C/A Factbook, BBC, various airlines, FSM Government			

Island	Telephone System	Radio Stations	TV Stations	ISPs
Kosrae	domestic: islands interconnected by shortwave radiotelephone (used mostly for government purposes), international: satellite earth stations - 4 Intelsat (Pacific Ocean) domestic: Majuro Atoll and Ebeye and Kwajalein islands have regular, seven-digit, direct-dial telephones; other islands interconnected by shortwave radiotelephone (used mostly for governmental purposes). International: satellite earth stations - 2 Intelsat (Pacific Ocean); US Government satellite communications system on Kwajalein (3700 main lines)	AM 5, FM 1, shortwave 0 2		1
Kwajalein		AM 3 FM 4	3 (2 of these US military)	military
Pohnpei	domestic: islands interconnected by shortwave radiotelephone (used mostly for government purposes), international: satellite earth stations - 4 Intelsat (Pacific Ocean)	AM 5, FM 1, shortwave 0 2		1
Temaiku	domestic: NA; inti: satellite earth station - Intelsat (Pacific Ocean). Note: Kiribati is being linked to the Pacific Ocean Cooperative Telecommunications Network, which should improve telephone service	AM 1 FM 1 shortwave 1 1		1
Tutuila	domestic: good telex, telegraph, facsimile, and cellular telephone services; domestic satellite system with 1 Comsat earth station; Intl: satellite earth station - 1 Intelsat (Pacific Ocean)	AM 1 FM 1 1		1
Weno	domestic: islands interconnected by shortwave radiotelephone (used mostly for government purposes), international: satellite earth stations - 4 Intelsat (Pacific Ocean)	AM 5, FM 1, shortwave 0 2		1
Yap	domestic: islands interconnected by shortwave radiotelephone (used mostly for government purposes), international: satellite earth stations - 4 Intelsat (Pacific Ocean)	AM 5, FM 1, shortwave 0 2		1
	Sources: CIA Factbook, BBC, various airlines, FSM Government			

Island	Ports and Harbors	Paved Airport Runways	> 3,047 m	2438 m - 3047 m	1523 m to 2437 m	914 m to 1523 m
Atafu	none; offshore anchorage only	0				
Diego Garcia	Diego Garcia	1	1			
Fongafale	Fongafale on Funafuti Atoll	1			1	
Gan	Gan	1		1		
Key West	Key West	1	1			
Kiritimati	English Harbor	1			1	
Koror	Koror	1			1	
Sources: CIA Factbook, BBC, various airlines, FSM Government						

Island	Ports and Harbors	Paved Airport Runways	> 3,047 m	2438 m - 3047 m	1523 m to 2437 m	914 m to 1523 m
Kosrae	Lelu	1			1	
Kwajalein	Kwajalein	1			1	
Pohnpei	Kolonia	1			1	
Temaiku		1			1	
Tutuila	Auasi and Pago Pago	1		1		
Weno	Weno	1			1	
Yap	Colonia	1			1	
Sources: CIA Factbook, BBC, various airlines, FSM Government						

Island	Military Bases	Flights from USA
Atafu		0
Diego Garcia	US lease on Diego Garcia expires in 2016	USA-Tokyo (several) - Tokyo-Diego Garcia (Navy)
Fongafale		Honolulu-Majuro (Continental) - Funafuti (Air Fiji)
Gan	The British RAF constructed an air base on Gan in the 1950s, but abandoned the facility in 1975. The British withdrawal hurt the economy through the 1980s. Only recently has the abandoned base been converted into a resort.	San Francisco-Hong Kong-Singapore-Male (Singapore Air) Male-Gan (Air Maldives)
Key West	Key West Naval Air Station	nearly all major US airlines
Kiritimati		Honolulu-Christmas Island (Aloha Airlines charter)
Koror		Honolulu-Guam-Palau (Continental)
Sources: CIA Factbook, BBC, various airlines, FSM Government		

Island	Military Bases	Flights from USA
Kosrae		Honolulu-Kosrae-(Continental)
Kwajalein	Kwajalein Missile Range	Honolulu-Majuro-Kwajalein (Continental) and Honolulu-Kwajalein (Aloha)
Pohnpei		Honolulu, Guam, Chuuk, Pohnpei (Continental)
Temaiku		Honolulu-Guam-Chuuk-Pohnpei (Continental) Pohnpei-Nauru-Tarawa (Air Nauru)
Tutuila		Honolulu-Pago Pago (Hawaiian Airlines)
Weno		Honolulu-Guam-Chuuk (Continental)
Yap		Honolulu-Guam-Yap (Continental)
Sources: CIA Factbook, BBC, various airlines, FSM Government		

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